JEFFERSON COUNTY ENVIRONMENTAL SERVICES DEPARTMENT

ASSET MANAGEMENT PROGRAM

Hazen

2019 PS01
2019 PUMP STATION UPGRADES NO.1
JEFFERSON METROPOLITAN, McADORY, AND COLEMAN LAKES

MAY 2021

BID SET

VOLUME 1 of 1
BIDDING AND CONTRACT REQUIREMENTS, TECHNICAL SPECIFICATIONS – DIVISION 1 THRU DIVISION 44, AND APPENDICIES

JEFFERSON COUNTY ENVIRONMENTAL SERVICES DEPARTMENT

2019 PUMP STATION UPGRADES NO. 1
JEFFERSON METROPOLITAN, McADORY, AND COLEMAN LAKES

TABLE OF CONTENTS

VOLUME 1 OF 1: BIDDING AND CONTRACT REQUIREMENTS, TECHNICAL SPECIFICATIONS – DIVISION 1 THRU DIVISION 44, AND APPENDICIES

CERTIFICATIONS

2019 PUMP STATION UPGRADES NO. 1 JEFFERSON METROPOLITAN, MCADORY, AND COLEMAN LAKES
GARVER PROJECT NO. 18138040
JEFFERSON COUNTY ENVIRONMENTAL SERVICES DEPARTMENT

I hereby certify that the applicable portions of this project plans and specifications were prepared by me or under my direct supervision and that I am a duly Licensed Engineer under the laws of the State of Alabama.

SEAL AND SIGNATURE	APPLICABLE DIVISION OR PROJECT RESPONSIBILITY
Trey D. Tidmore, P.E.  Digitally Signed: May 7, 2021	All Divisions Except Those Noted Otherwise
Jonathan C. White, P.E.  Digitally Signed: May 7, 2021	Division 26

CERTIFICATIONS

Kipp A. Martin, P.E.  Digitally Signed: May 7, 2021	Divisions 03 - 08

GARVER, LLC CERTIFICATE OF AUTHORIZATION:
AL ENGINEERING COA NO. 500-E Expiration Date: 01/31/2022

NOTICE TO BIDDERS

Sealed Bid Proposals will be received by the Environmental Services Department, Jefferson County, Alabama, online at QuestCDN (eBidDoc #7823340), until **2:00 P.M.** local time on **Wednesday**, **June 23, 2021** and then publicly opened and read via virtual video conference using Microsoft Teams for the **2019 PUMP STATION UPGRADES NO.1 JEFFERSON METROPOLITAN, McADORY, AND COLEMAN LAKES .** Microsoft Teams can be accessed using a direct invitation link sent via email (request this link from Tad Powell, Hazen and Sawyer, at email tpowell@hazenandsawyer.com).

The scope of work includes the construction of two (2) wastewater pumping stations including but not limited to demolition of existing pumping stations, construction of concrete wet well and valve vault, construction of a CMU-building, installation of piping, valves, pumps, electrical components, conduit, wiring, and other appurtenances as necessary, and other miscellaneous facility and site improvements. Work also includes the repair of existing pumps and wet well coating at the Coleman Lakes pumping station. Construction of approximately 1,660 linear feet of 6-inch HDPE force main pipe will also be required.

Bidding Documents are on file for inspection, by appointment only, at the following location:

Jefferson County Environmental Services Department
Shades Valley Training Facility
1331 Oak Grove Road
Birmingham, Alabama 35209
Contact for Appointment: Brian Rohling at (205) 521-7512

Complete sets of electronic Bidding Documents (Specifications and Drawings) are available at www.jeffcoes.org (navigate to "BUSINESS" to "NOTICE TO BIDDERS" to "Asset Management Program – Project Bid Information" for a listing of projects. Prior to downloading the Bidding Documents, Bidders will be required to set up a QuestCDN.com account and pay a $30.00 fee. Hard copies of the Bidding Documents are the responsibility of the Bidders. Contact QuestCDN at 952-233-1632 or info@questcdn.com for assistance with navigating the website and digital project information.

Bids will only be accepted from pre-qualified contractors who are listed on the Plan Holders List, signifying that they have purchased a set of documents from the Engineer, and who attend the MANDATORY Pre-Bid Conference.

NO BID PROPOSAL SHALL BE ACCEPTED AFTER THE TIME STATED FOR RECEIVING BID PROPOSALS IN THIS NOTICE. A FORM CONTAINING THE CONTRACTOR'S NAME AND ADDRESS OF THE FIRM AND THE CONTRACTOR'S ALABAMA LICENSE NUMBER WITH THE DATE OF EXPIRATION IS REQUIRED WITH THE SUBMISSION OF THE BID. THESE REQUIREMENTS SHALL NOT BE WAIVED.

The Contractor is hereby advised that TIME IS OF THE ESSENCE on this project. The Contract Time for this project is **three hundred sixty-five (365)** consecutive calendar days from the effective date of the written Notice to Proceed to achieve Final Acceptance. Liquidated damages will be assessed if this time limit is exceeded. The Contractor may apply for an extension of time in accordance with the provisions of the Contract; however, such an extension must be approved prior to the Contract Completion Date to avoid the imposition of liquidated damages.

The Contractor is hereby advised that a Pre-Bid Conference will be held via a virtual video conference on Wednesday, June 9, 2021 at 10:00 a.m. This Pre-Bid Conference is MANDATORY for all contractors planning to submit a Bid Proposal on this project. The conference call will be held using Microsoft Teams and can be accessed using a direct invitation link sent via email (request this link from Tad Powell, Hazen and Sawyer, at email tpowell@hazenandsawyer.com). If you are unable to join the call due to technical difficulties, call Tad Powell (Hazen and Sawyer) at 205-957-4151 or Brian Rohling (Jefferson County) at 205-521-7512 for assistance.

Questions concerning meaning or intent of Bidding Documents shall be submitted to Tad Powell, PE, Senior Associate, Hazen and Sawyer, at email tpowell@hazenandsawyer.com no later than 5:00 p.m. local time on June 11, 2021. All questions must be in writing on Bidder's company's letterhead.

THE ATTENTION OF ALL BIDDERS IS CALLED TO THE PROVISIONS OF THE STATE LAW GOVERNING GENERAL CONTRACTORS, AS SET FORTH IN ALABAMA CODE SECTIONS 34-8-1 THROUGH SECTION 34-8-28 (1975), AS AMENDED, CHAPTER 4, SECTION 65 TO 82 (INCLUSIVE) OF TITLE 46 OF THE CODE OF ALABAMA OF 1940, AS AMENDED; AND BIDDERS SHALL BE GOVERNED BY SAID LAW INSOFAR AS IT IS APPLICABLE. THE ABOVE MENTIONED PROVISIONS OF THE CODE MAKE IT ILLEGAL FOR THE OWNER TO CONSIDER A BID PROPOSAL FROM ANYONE WHO IS NOT PROPERLY LICENSED UNDER SUCH CODE PROVISIONS.

THE ATTENTION OF BIDDERS IS CALLED TO THE PROVISIONS OF ALABAMA CODE SECTION 39-2-14 (1975) AS AMENDED, REQUIRING A NONRESIDENT CONTRACTOR TO REGISTER WITH THE DEPARTMENT OF REVENUE PRIOR TO ENGAGING IN THE PERFORMANCE OF A CONTRACT IN THE STATE OF ALABAMA.

THE ATTENTION OF BIDDERS IS CALLED TO THE PROVISIONS OF ALABAMA CODE SECTION 39-3-5 (1975) AS AMENDED, REGARDING PREFERENCE TO RESIDENT CONTRACTORS.

THE ATTENTION OF BIDDERS IS CALLED TO THE PROVISIONS OF ALABAMA ACT 2016-312 AS AMENDED, REGARDING NOT ENGAGING IN THE BOYCOTT OF A PERSON OR ENTITY BASED IN OR DOING BUSINESS WITH A JURISDICTION WITH WHICH THIS STATE ENJOYS OPEN TRADE.

THIS PROJECT IS CLASSIFIED AS A **Class "D" (PUMP STATION AND PACKAGE PLANT FACILITY)** SEWER PROJECT. ALL PROSPECTIVE BIDDERS MUST BE PRE-QUALIFIED WITH THE JEFFERSON COUNTY ENVIRONMENTAL SERVICES DEPARTMENT TO BID **CLASS "D"** PUMP STATION AND PACKAGE PLANT PROJECTS IN ORDER TO BID ON THIS PROJECT. TO PRE-QUALIFY WITH THE DEPARTMENT AND TO CONSTRUCT CLASS "D" PUMP STATION AND PACKAGE PLANT PROJECTS, EACH PROSPECTIVE BIDDER MUST FURNISH WRITTEN EVIDENCE OF COMPETENCY AND EVIDENCE OF FINANCIAL RESPONSIBILITY TO THE COUNTY.

ACCORDINGLY, THE COUNTY WILL NOT ACCEPT PRE-QUALIFICATIONS AFTER **June 4, 2021 .** BID PROPOSAL FORMS WILL NOT BE ISSUED TO PROSPECTIVE BIDDERS WHO DO NOT PRE-QUALIFY.

CONTRACTORS ARE ENCOURAGED TO CONTACT THE JEFFERSON COUNTY ENVIRONMENTAL SERVICES DEPARTMENT, 716 RICHARD ARRINGTON JR. BOULEVARD NORTH, SUITE A300, BIRMINGHAM, ALABAMA, (205) 325-5496 IN ADVANCE OF THE DEADLINE TO DETERMINE IF THE CONTRACTOR IS PRE-QUALIFIED TO CONSTRUCT **CLASS "D"** SEWER PROJECTS, OR FOR OTHER INFORMATION REGARDING THE REQUIREMENTS FOR PRE-QUALIFICATION.

BY: 

David Denard
Director of Environmental Services
Jefferson County, Alabama

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SECTION 00101

INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Prequalification of Bidders

B. Bid Proposal Form

C. Issuance of Bid Proposal Forms

D. Interpretation of Estimated Bid Proposal Quantities

E. Examination of Contract Documents and Site of the Work

F. Preparation of Bid Proposal

G. Rejection of Bid Proposals

H. Bid Proposal Guaranty

I. Delivery of Bid Proposal

J. Withdrawal or Revision of Bid Proposals

K. Public Opening of Bid Proposals

L. Disqualification of Bidders

M. Consideration of Bid Proposals

N. Award of Contract

O. Cancellation of Award

P. Return of Bid Proposal Guaranty (Certified Checks)

Q. Requirements of Contract Bonds

R. Execution of Contract

S. Approval of Contract

T. Failure to Execute Contract

U. Nondiscrimination in Employment

1.02 **PREQUALIFICATION OF BIDDERS**

A. The excavation portion of this project is classified as a **Class "D" (Pump Station and Package Plant Facility)** project. Only those contractors pre-qualified to bid work for the Jefferson County Environmental Services Department in this classification of projects will be allowed to submit Bids for this project. To obtain Pre-qualification status, each Bidder shall furnish the Owner satisfactory evidence of his competency to perform the proposed Work. Such evidence of competency, unless specified otherwise, shall consist of statements covering the Bidder's past experience on similar work, a list of equipment that would be available for the Work, and a list of key personnel that would be available. In addition, each Bidder shall furnish the Owner satisfactory evidence of his financial responsibility. Such evidence of financial responsibility, unless specified otherwise, shall consist of a confidential statement or report of the Bidder's financial resources and liabilities as of the last calendar year or the Contractor's last fiscal year. Such statements or reports shall be certified by a public accountant. At the time of submitting such financial statements or reports, the Bidder shall further certify whether his financial responsibility is approximately the same as stated or reported by the public accountant. If the Bidder's financial responsibility has changed, the Bidder shall qualify the public accountant's statement or report to reflect his (Bidder's) true financial condition at the time such qualified statement or report is submitted to the Owner.

B. Along with a signed Pre-qualification Application, each Pre-qualification applicant shall submit "evidence of competence" and "evidence of financial responsibility" to the Jefferson County Environmental Services Department, 716 Richard Arrington Jr. Boulevard North, Suite A300, Birmingham, Alabama 35203, no later than the deadline date for receipt of Pre-Qualification Applications as specified in Section 00100 – Notice to Bidders.

C. Once a Bidder has pre-qualified to submit a Bid Proposal on County work, said Bidder will not be required to resubmit the Pre-qualification documents previously specified herein in order to bid subsequent work of a similar nature unless specifically requested to do so by the Jefferson County Environmental Services Department. Pre-qualification shall be applicable only to the particular individual, partnership, firm, corporation, or joint venture named in the documents submitted as evidence of competence and financial responsibility.

D. All Bidders must be licensed contractors in the State of Alabama at the time Bid Proposals are submitted, and each Bidder must furnish certain information

pertaining to the State License on the outside of the Bid Proposal envelope in accordance with requirements of this Section, or said Bid Proposals will not be opened.

1.03 BID PROPOSAL FORM

A. The Owner has furnished Bidders with a Bid Proposal Form online at QuestCDN which contains a list of materials to be furnished and/or items of work to be done. The Bid Proposal Form is presented in Section 00300 – Bid Proposal. As part of the Bidding Documents, the Engineer will require the following documents online at QuestCDN. Each bidder will be required to complete and submit as their complete Bid Proposal as follows:

1. Bid Envelope Information

2. Section 00300 – Bid Proposal

3. Section 00350 – Non-Collusion Affidavit

4. Section 00360 – MBE/DBE Documentation Statement Jefferson County Commission Environmental Services Department

5. Section 00410 – Bid Bond

6. Section 00430 – List of Subcontractors

7. Appendix C – Jefferson County Environmental Services Department MBE/DBE Forms

8. Appendix D – State of Alabama Resident Status Form

9. Appendix E – Jefferson County, Alabama – Equal Employment Opportunity Certification Form

B. The Drawings, Specifications, and other documents designated in the Bid Proposal shall be considered a part of the Bid Proposal, whether attached or not.

C. Clarifications, corrections, and minor changes to the Bid Proposal Form, Specifications, or Drawings may be put into effect through a numbered addendum issued by facsimile, by certified letter, or by hand delivery from the Owner or Engineer, notifying all prospective Bidders to whom Bid Proposal Forms have been previously issued.

1. Questions concerning meaning or intent of Bidding Documents shall be submitted to Tad Powell, PE, Associate, Hazen and Sawyer, at email

tpowell@hazenandsawyer.com. All questions must be in writing on Bidder's company's letterhead. Questions submitted may or may not be answered via Addenda. Any and all replies to questions will be issued by Addenda online at QuestCDN to all plan holders. Questions received after 5:00 p.m. local time on June 11, 2021 will not be answered. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

2. Addenda may be issued to modify any part of the Contract Documents as deemed necessary by the Engineer or Owner.

1.04 ISSUANCE OF BID PROPOSAL FORMS

A. The Owner reserves the right to refuse to issue a Bid Proposal Form to a prospective Bidder, should such Bidder be in default for any of the following reasons:

1. Failure to comply with any prequalification regulations of the Owner, if such regulations are cited, or otherwise included, in the Specifications as a requirement for bidding.

2. Failure to pay or satisfactorily settle all valid bills due for labor and materials on former Contracts in force (with the Owner) at the time the Owner issues the Bid Proposal Form to a prospective Bidder.

3. Contractor default under previous Contracts with the Owner.

4. Unsatisfactory work, at the sole discretion of the Owner, on previous Contracts with the Owner.

5. Failure to prequalify as required in this section.

1.05 INTERPRETATION OF ESTIMATED BID PROPOSAL QUANTITIES

A. The quantities of the Work and materials shown on the Bid Proposal Form or on the Drawings are believed to represent the approximate volume of Work to be performed and materials to be furnished and are to be used for comparison of Bid Proposals. Payment to the Contractor will be made only for the actual quantities of work performed or materials furnished and in accordance with the procedures set out in the Drawings and Specifications and it is understood that the quantities may be increased or decreased as hereinafter provided without invalidating the bid prices in any way.

1.06 EXAMINATION OF CONTRACT DOCUMENTS AND SITE OF THE WORK

A. Bidders are advised that the Drawings, Specifications, and Addenda, if any,

constitute all the information which the Owner will furnish for Bidding. Except those items listed in the preceding sentence, no information given by the Owner, or any representative thereof, prior to the execution of the Contract shall become a part of or change the Contract Drawings or Specifications or be binding upon the Owner. Bidders are required, prior to submitting a Bid Proposal, to read carefully the Specifications, the Bid Proposal, Contract and Bond forms; to examine the Drawings; to visit the site of the Work; to carefully examine local conditions; to inform themselves by their independent research of the difficulties to be encountered; and judge for themselves of the accessibility of the Work and all attending circumstances affecting the cost of doing the Work or the time required for its completion and obtain all information required to make an informed Bid Proposal. Bidders shall rely exclusively upon their own estimates, investigation, and other data which are necessary for full and complete information upon which the Bid Proposal may be based. It is mutually agreed that submission of the Bid Proposal will be prima facie evidence that the Bidder has made the examination and investigations required herein.

1.07 PREPARATION OF BID PROPOSAL

A. The Bidder shall submit his Bid Proposal on the Bid Proposal Form furnished by the Owner. Each item for which a quantity of Work is shown shall show a unit price, and each item shall be correctly extended and summarized. Should there develop a discrepancy between the unit price and the extended amount shown, the unit price shall govern and the extended amount shall be corrected.

B. The Bid Proposal must be signed in black ink by the individual, by one or more members of the partnership, by one or more members or officers of each firm representing a joint venture, by one or more officers of a corporation, or by an agent of the Contractor legally qualified and acceptable to the Owner.

C. If the Bid Proposal is made by an individual, his name and post office address must be shown; by a partnership, the name and post office address of each partnership member must be shown; as a joint venture, the name and post office address of each member or officer of the firms represented by the joint venture must be shown; by a corporation, the name of the corporation and the business address of its corporate officials must be shown.

D. Anyone signing a Bid Proposal as an agent shall file evidence of his authority to do so and that his signature is binding upon the firm or corporation.

E. The Bidder certifies with his Bid Proposal that prices bid shall be firm for a period of 75 days from date of the Bid Proposal or for a longer time if mutually agreeable by the Owner and the Contractor.

F. Bid shall contain acknowledgment Bidder has received Addenda (Addenda

numbers shall be filled in on Bid Proposal).

1.08 REJECTION OF BID PROPOSALS

A. Bid Proposals may be considered irregular and rejected for the following reasons:

1. If the Bid Proposal is on a form other than that furnished by the Owner, or if the Owner's form is altered.

2. If there are unauthorized additions, conditional, or alternate pay items, or irregularities of any kind which make the Bid Proposal incomplete, indefinite, or otherwise ambiguous as may be determined by the Owner.

3. If it is determined that the Bidder did not prequalify as previously required herein.

4. If the Bid Proposal does not contain a unit price for each pay item listed in the Bid Proposal.

5. If the Bid Proposal contains unit prices that are obviously unbalanced.

6. If the Bid Proposal is not accompanied by the Bid Proposal Guaranty specified by the Owner.

7. If the Bid Proposal does not include the form with the name of the project, the contractor’s name and address, and the contractor’s Alabama license number with date of expiration on the front of the envelope.

B. The Owner reserves the right to reject any and all Bid Proposals and the right to waive technicalities and/or informalities, if such waiver is in the best interest of the Owner and conforms to local laws and ordinances pertaining to the letting of construction contracts.

1.09 BID PROPOSAL GUARANTY

A. Each Bidder must submit with his Bid Proposal a Bid Bond made by a company qualified and authorized to transact business in the State of Alabama in an amount not less than five percent (5%) of the total amount of his Bid Proposal, not to exceed $10,000.00, as a guaranty that if awarded a Contract, the Bidder will execute the required Contract and furnish the required construction bonds (surety bonds) within ten (10) days after date of notice of such award.

1.10 DELIVERY OF BID PROPOSAL

A. Each Bid Proposal must be filed online at QuestCDN within the time limit for receiving Bid Proposals as stated in Section 00100 – Notice to Bidders, and shall be made on the online Bid Worksheet on QuestCDN. Bidders will be charged a fee of $30.00 to electronically submit a Bid Proposal. All Bid Proposals must have the online Bid Worksheet and the associated documentation as listed in Article 1.03 herein submitted online at QuestCDN. Bid Proposals filed after the scheduled date and time of receiving Bid Proposals will not be considered and will be rejected online at QuestCDN.

1.11 WITHDRAWAL OR REVISION OF BID PROPOSALS

A. A Bidder may withdraw or revise a Bid Proposal, provided that the Bidder's request for withdrawal or revision is received by the Owner before the time specified for opening bids. Revised Bid Proposals must be received at the place specified in the advertisement before the deadline specified for receiving all bids.

1.12 PUBLIC OPENING OF BID PROPOSALS

A. Bid Proposals shall be opened and read aloud via virtual video conference at the time and date specified in Section 00100 – Notice to Bidders. Bidders, their authorized agents, and other interested persons are invited to attend.

B. Bid Proposals that have been withdrawn or received after the time specified for receiving bids shall be deemed “REJECTED” online at QuestCDN and left unopened.

C. The time shall be as determined by the countdown clock on QuestCDN.

1.13 DISQUALIFICATION OF BIDDERS

A. A Bidder shall be considered disqualified for any of the following reasons:

1. Submitting more than one Bid Proposal from the same individual, partnership, firm, or corporation under the same or different name.

2. Evidence of collusion among Bidders. Bidders participating in such collusion shall be disqualified as Bidders for any future work of the Owner until any such participating Bidder has been reinstated by the Owner as a qualified Bidder.

3. If the Bidder is considered to be in "default" for any reason specified in this section.

1.14 CONSIDERATION OF BID PROPOSALS

A. After the Bid Proposals are opened and read via virtual video conference, they will be compared on the basis of the summation of the lump sum, unit prices, and extended totals.

B. Until the award of the Contract is made, the Owner reserves the right to reject a Bid Proposal for any of the following reasons:

1. If the Bid Proposal is irregular as specified in this section.

2. If the Bidder is disqualified for any of the reasons specified in this section.

C. Until the award of the Contract is made, the Owner reserves the right to reject any or all Bid Proposals; waive technicalities, if such waiver is in the best interest of the Owner and is in conformance with applicable state and local laws or regulations pertaining to the letting of construction contracts; advertise for new Bid Proposals; or proceed with the work otherwise. All such actions shall promote the Owner's best interests.

1.15 AWARD OF CONTRACT

A. The award of the Contract, if made, shall be to the lowest responsive, qualified Bidder whose Bid Proposal complies with the requirements of the Owner. The Owner shall have 75 days to award the contract.

B. Before an award is made, the Owner reserves the right to investigate the previous experience, financial status, and general reputation of all Bidders.

1.16 CANCELLATION OF AWARD

A. The Owner reserves the right to cancel the award of the Contract without liability to the Bidder, except return of Bid Proposal Guaranty, at anytime before a Contract has been fully executed by all parties and is approved by the Owner in accordance with the requirements of this section.

1.17 REQUIREMENTS OF CONTRACT BONDS

A. With the execution and delivery of the Contract, the Contractor shall furnish to the Owner a Performance Bond for the full amount of the Contract and a Payment Bond for an amount not less than one hundred percent (100%) of the total amount of the Contract and for the payment of all persons performing labor and furnishing materials under the Contract. Maintenance provisions of the bonds shall remain in effect for twelve (12) months after completion and acceptance of the Work. The Contract completion date shall be designated as the date of

execution of the final estimate by the Owner. The bonds shall be in a form satisfactory to the Owner. The surety shall be a reputable bonding company authorized to transact business in the State of Alabama and shall be acceptable to the Owner.

1.18 EXECUTION OF CONTRACT

A. The Contract shall be executed by the successful Bidder and returned to the Owner with acceptable Contract bonds together with Insurance documents required under Section 00822 – Insurance Requirements within ten (10) days after the date of Notice of Award by the Owner. The Contract, bonds, and other documents, shall be approved by the Owner's attorney, if required, before acceptance and execution by the Owner.

1.19 APPROVAL OF CONTRACT

A. Upon receipt of the Contract, the Contract bonds, and the complete insurance documents, the Owner shall review and complete the execution of the Contract in accordance with local laws and ordinances, and return the fully executed Contract to the Contractor. Delivery of the fully executed Contract to the Contractor shall constitute the Owner's approval to be bound by the successful Bidder's Bid Proposal and the terms of the Contract.

1.20 FAILURE TO EXECUTE CONTRACT

A. Should the successful Bidder to whom the Contract has been awarded fail to execute the Contract and furnish satisfactory Contract Bonds and Insurance Requirements within ten (10) days after date of Notice of Award, it shall be considered that he has abandoned his Bid Proposal. The tender of Contract may be withdrawn by the Owner, and the amount of the Bid Proposal Guaranty shall be forfeited to the Owner. The filing of a Bid Proposal by any Bidder shall be considered as an acceptance by him of this provision.

B. In the event of the death of the successful Bidder (if an individual and not a partnership or corporation) between the date of the opening of the Bid Proposals and the l0 days following the date of award of the Contract as required by these Specifications for furnishing Contract bonds and insurance documents and executing the Contract, the Bid Proposal Guaranty will be returned intact to the estate of the deceased successful Bidder and the project either rebid or awarded to the second low Bidder, at the discretion of the Owner.

1.21 NONDISCRIMINATION IN EMPLOYMENT

A. Contracts for Work under this Bid Proposal will obligate the contractors and subcontractors not to discriminate in employment practices.

B. Bidders must comply with the President's Executive Order No. 11246; one requirement of which is that all qualified applicants will receive consideration for employment without regard to race, creed, color, sex, disability, or national origin.

C. Bidder must also comply with Jefferson County's anti-discrimination policy contained in administrative order AO 2008-04 by executing the form attached hereto as Appendix E.

END OF SECTION

SECTION 00300

BID PROPOSAL

DATE: _____/_____/_____

TO: The Commission of
Jefferson County
Birmingham, Alabama

Gentlemen:

In response to your request the undersigned Bidder submits this Bid Proposal for the **2019 PUMP STATION UPGRADES NO. 1 JEFFERSON METROPOLITAN, McADORY, AND COLEMAN LAKES** as described and specified in the Drawings and Specifications:

1. Bidder proposes and agrees, in the event this Bid Proposal be accepted, to enter into a Contract with the above named Commission (herein designated and referred to as the Owner), in the form herein specified, to furnish all materials, equipment, machinery, tools, means of transportation, power and fuel, and to perform all labor necessary for or incidental to the construction of the aforementioned improvements, all in complete accordance with the requirements of the Contract Documents, to the entire satisfaction of the Owner, at the unit and lump sum prices we have inserted opposite each item of work listed in the accompanying Bid Proposal Form, which is an integral part of this Bid Proposal.

2. In submitting this Bid Proposal, the Bidder understands and agrees that a Contract may be awarded for the Work as may appear to the interest of the Owner; that the quantities as stated are approximate only; that no claim shall be made against the Owner on account of any excess or deficiency, either absolute or relative, therein; that the estimated quantities will be used as a basis for canvassing and evaluating Bid Proposals and for determining the estimated amount of the Contract; and that, within the limits of available funds, the Owner reserves the right to increase or decrease the estimated quantities by such amounts as may be necessary to complete the Work, provided, however, that the stated unit prices shall remain firm and unchanged.

3. Bidder hereby declares that the only person or persons interested in this Bid Proposal as principal or principals is, or are, named herein and that no other person than herein mentioned has any interest in this Bid Proposal or in the Contract to be entered into, that this Bid Proposal is made without connection with any other person, company, or parties making Bid Proposal, and that this Bid Proposal is in all respects fair and made in good faith without collusion or fraud.

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4. Bidder further declares that he has examined the site of the Work and the building and labor conditions and has informed himself fully in regard to all conditions pertaining to the place where the Work is to be done; that he has examined the Drawings and these Specifications for the Work and other Contract Documents relating thereto and has read all Special Conditions furnished prior to the opening of bids; and that he has satisfied himself relative to the Work to be performed.

5. Bidder further proposes and agrees that, if awarded a Contract for this project, he will commence Work immediately on or before the date stated in a written notice from the Owner to commence Work; that he will furnish all materials, and perform all labor for the completion of the Contract and will complete same, including all accepted alternates thereto, within the time stated in the Special Conditions; and that on his failure to complete the Work within such time he will pay to the Owner for each calendar day that the Work, or any part thereof remains uncompleted beyond such specified time, the amount specified in the Special Conditions; this payment shall be made as liquidated damages.

6. The Bidder further declares that accompanying this Bid Proposal is a certified check or satisfactory Bid Bond in the sum of five percent (5%) of this Bid Proposal, not to exceed $10,000.00 and it is hereby agreed that in case of the withdrawal of this Bid Proposal without the consent of the Owner within one seventy five (75) days after the Bid opening, or that in case of failure on the part of the undersigned to execute the Contract as aforesaid and to deliver same and the required security for the faithful performance of the Contract (executed in the form annexed hereto), to said Owner within ten days from the date a notice of acceptance of this Bid Proposal is given to the undersigned personally, or by mail to the address as herein stated, then the undersigned Bidder will be deemed to have abandoned the Contract, and thereupon the amount of such check or bond shall be absolutely due and payable thereunder to the Owner.

7. The Bidder further declares his understanding that the Bid Proposal may contain quantities for Bid Items that exceed the quantities identified in the Contract Documents. If applicable, the quantities that are not shown in the Contract Documents may be identified by the Owner and/or Engineer and, if so identified, will be completed in this Contract.

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_____
Individual or Firm Name of Bidder

Bidder's Address_____

Bidder's Telephone Number (include area code):_____

Bidder's Email Address:_____

Bidder's State of Alabama License Number:_____

Licensed to be awarded Contracts not exceeding:_____

Note: If the Bidder is a corporation, give the following information:

State in which incorporated:_____

Address of Principal Office:_____

The Contractor is advised that TIME IS OF THE ESSENCE on this project and that the Contract time of **365** consecutive calendar days from the effective date of the written Notice to Proceed to achieve Final Acceptance shall be strictly observed. LIQUIDATED DAMAGES WILL BE ASSESSED IF THE CONTRACT TIME IS EXCEEDED. The Contractor may apply for an extension of time in accordance with provisions of the Contract and these Specifications; however, such an extension of time must be approved PRIOR to the Contract completion date to avoid the imposition of liquidated damages. The Contractor is referred to Section 01015 – Prosecution and Progress and to the Special Conditions.

Bidder has examined the following addenda, and receipt of them is acknowledged:

No. _____	Dated _____	No. _____	Dated _____
No. _____	Dated _____	No. _____	Dated _____
No. _____	Dated _____	No. _____	Dated _____
No. _____	Dated _____	No. _____	Dated _____

Signature of Bidder:_____

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BID PROPOSAL FORM

2019 PUMP STATION UPGRADES NO. 1
JEFFERSON METROPOLITAN, MCADORY, AND COLEMAN LAKES

All Bid Items shall include costs for furnishing to Owner all materials, equipment, and supplies and for all costs incurred in completing the Work, including installation of all materials, equipment, and supplies furnished, complete in-place and ready for continuous service, and all other labor, permit fees, taxes, insurance, miscellaneous costs, overhead, and profit.

ITEM NO.	ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION AND DEMOBILIZATION (NOT TO EXCEED 5% OF THE GRAND TOTAL OF BID)	LS	1	$	$
2	ALLOWANCE FOR NATURAL GAS SERVICE IMPROVEMENTS	ALLOW	1	$ 20,000	$ 20,000
3	ALLOWANCE FOR REFURBISHMENT OF PUMPING EQUIPMENT AT COLEMAN LAKES PUMP STATION	ALLOW	1	$ 35,000	$ 35,000
4	JEFFERSON METROPOLITAN PUMP STATION IMPROVEMENTS	LS	1	$	$
5	COLEMAN LAKES PUMP STATION IMPROVEMENTS	LS	1	$	$
6	McADORY PUMP STATION IMPROVEMENTS	LS	1	$	$
7	6-INCH HDPE FORCE MAIN AND REQUIRED APPURTENANCES (BEDDING INCLUDED)	LF	1,600	$	$
8	6-INCH DIAMETER D.I.P. 45 DEGREE BEND AND REQUIRED APPURTENANCES	EA	3	$	$
9	6-INCH DIAMETER D.I.P. 22.5 DEGREE BEND AND REQUIRED APPURTENANCES	EA	1	$	$
10	6-INCH D.I. GATE VALVE AND REQUIRED APPURTENANCES	EA	1	$	$
11	CONNECTION TO EXISTING 6-INCH FORCE MAIN	EA	1	$	$
12	CORE DRILL AND CONNECTION TO EXISTING SANITARY SEWER MANHOLE	EA	1	$	$
13	2-INCH AIR RELIEF / ANTI-VACUUM VALVE AND VAULT AND REQUIRED APPUTENANCES	EA	1	$	$
14	LUMP SUM ROADWAY BORE – 75 LF OF 12-INCH STEEL CASING (0.25” THICK) W/ 75 LF OF 6-INCH HDPE CARRIER PIPE	LS	1	$	$
15	PORTLAND CEMENT CONCRETE PAVING	SY	75	$	$
16	ASPHALT CONCRETE PAVING	SY	110	$	$
17	TEMPORARY AND PERMANENT GRASSING	AC	1	$	$

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ITEM NO.	ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	TOTAL AMOUNT
18	SILT FENCING	LF	1,800	$	$
19	ADDITIONAL EROSION CONTROL MEASURES	LS	1	$	$
20	TRAFFIC CONTROL	LS	1	$	$
21	ALLOWANCE FOR OWNER-DIRECTED ADDITIONAL ELECTRICAL IMPROVEMENTS	ALLOW	1	$ 25,000	$ 25,000
22	ALLOWANCE FOR OWNER-DIRECTED ADDITIONAL STRUCTURAL IMPROVEMENTS	ALLOW	1	$ 25,000	$ 25,000
23	ALLOWANCE FOR OWNER-DIRECTED ADDITIONAL CIVIL IMPROVEMENTS	ALLOW	1	$ 25,000	$ 25,000
24	ALLOWANCE FOR OWNER-DIRECTED ADDITIONAL MECHANICAL IMPROVEMENTS	ALLOW	1	$ 25,000	$ 25,000
25	ALLOWANCE FOR MATERIALS TESTING	ALLOW	1	$ 15,000	$ 15,000
26	ALLOWANCE FOR START-UP, TESTING, AND USE OF NEW FACILITIES	ALLOW	1	$ 20,000	$ 20,000
	GRAND TOTAL OF BID (ITEMS 1 THROUGH 26)				$

In the event of a discrepancy between the unit price bid and the extended total amount, the unit price will be deemed intended by the bidder and the extended total amount shall be adjusted. In the event of a discrepancy between the sum of the extended amounts and the Grand Total of Bid, the sum of the extended amounts shall govern.

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SECTION 00350

NON-COLLUSION AFFIDAVIT

STATE OF ALABAMA
JEFFERSON COUNTY

BID PROPOSAL DATE: _____

I hereby certify that _____(Name of Contracting Firm) has not either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with this Contract.

Signed: _____
(Name of Contracting Firm)

By:_____

Sworn to and subscribed before me this _____ day of _____, 20_____

_____
Notary Public

FAILURE TO EXECUTE THIS AFFIDAVIT SHALL BE CAUSE FOR REJECTION OF THIS BID PROPOSAL.

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SECTION 00360

MBE/DBE DOCUMENTATION STATEMENT JEFFERSON COUNTY COMMISSION ENVIRONMENTAL SERVICES DEPARTMENT

PROJECT NAME: **2019 PUMP STATION UPGRADES NO. 1 JEFFERSON METROPOLITAN, McADORY, AND COLEMAN LAKES**

The Jefferson County Commission, Environmental Services Department has initiated a program to encourage the participation of Minority Business Enterprises/Disadvantaged Business Enterprises (MBE/DBE) on its construction projects. This signed statement serves as a commitment by the undersigned company to comply with this program as outlined in Specification Section 00630, JEFFERSON COUNTY ENVIRONMENTAL SERVICES DEPARTMENT MBE/DBE PROGRAM.

Signature	Date
Principal and Title (Print or Type)	
Company Name	Alabama Contractor License Number
Mailing Address	Telephone Number
City, State Zip	Fax Number

INSTRUCTIONS:

1. **FAILURE TO EXECUTE THIS STATEMENT MAY BE CAUSE FOR REJECTION OF THIS BID.**
2. **SUBMIT WITH BID DOCUMENTS.**

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SECTION 00410

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, as Principal, and _____ a Surety, are hereby held and firmly bound unto Jefferson County, Alabama, as OWNER in the penal sum of _____ _____for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

Signed, this_____ day of _____, 20___.

The condition of the above obligation is such that whereas the Principal has submitted to Jefferson County, Alabama, a certain Bid Proposal, attached hereto and hereby made a part hereof to enter into a Contract in writing, for the **2019 PUMP STATION UPGRADES NO. 1 JEFFERSON METROPOLITAN, McADORY, AND COLEMAN LAKES.**

NOW, THEREFORE,

(a) If said Bid Proposal shall be rejected, or in the alternate,

(b) If said Bid Proposal shall be accepted and the Principal shall execute and deliver a Contract in the form of Contract attached hereto (Properly completed in accordance with said Bid Proposal) and shall furnish a bond for his faithful performance of said Contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid Proposal, then this obligation shall be void, otherwise the same remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid Proposal; and said Surety does hereby waive notice of any such extension. IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers the day and year first set forth above.

Principal _____(L.S.)

Surety_____

SEAL By_____

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SECTION 00430

LIST OF SUBCONTRACTORS

In compliance with the Instructions to Bidders and other Contract Documents, the undersigned submits the following names of subcontractors to be used in performing the Work for the **2019 PUMP STATION UPGRADES NO. 1 JEFFERSON METROPOLITAN, McADORY, COLEMAN LAKES.**

Bidder certifies that all subcontractors listed are eligible to perform the Work.

Subcontractor's Work	Subcontractor's Name

NOTE: This form must be submitted with the Bid in accordance with the Instructions to Bidders.

_____
Bidder's Signature

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SECTION 00500

CONTRACT

THIS CONTRACT, made and entered into this the _____day of _____20____, by and between Jefferson County, Alabama hereinafter referred to as the Owner and _____ _____ hereinafter referred to as the Contractor.

WITNESSETH:

That the parties hereto do mutually agree as follows:

1. The Contractor will furnish all materials, equipment, supplies, tools, power, fuel, and services and perform all labor necessary for the **2019 PUMP STATION UPGRADES NO. 1 JEFFERSON METROPOLITAN, McADORY, AND COLEMAN LAKES,** and will perform same in strict conformity with the terms and conditions set forth in the following named documents which are hereto attached and made a part of this contract:

   Project No. _____: Notice to Contractors, Special Conditions, Bid Proposal, Wage Rates, Performance Bond, Payment Bond, and Contract Drawings as enumerated and identified in these Specifications.

2. The Owner will pay to the Contractor, on faithful performance of his undertakings hereunder, in lawful money of the United States, the respective unit prices set forth in the aforementioned Bid Proposal for each unit of work performed or installed by the Contractor, the estimated sum total of all payments hereunder being _____dollars ($_____).

3. The Owner will make payments to the Contractor as specified in these Specifications.

4. Within a period of 30 days after completion and acceptance of the Work the Owner will make a final and complete payment in full to the Contractor on account of this Contract; provided that, during said 30 day period, the Contractor has submitted to the Owner satisfactory written evidence that all payrolls and other costs incurred by the Contractor in connection with the Work have been paid in full; otherwise final payment will be made only after such evidence has been submitted.

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5. The Contractor will commence the Work on or as of the date set in a notice from the Owner to proceed with the Work, will prosecute same diligently and continuously with the stated requirements within **three hundred thirty (330)** consecutive calendar days from the effective date of the written Notice to Proceed to achieve Substantial Completion and **three hundred sixty (365)** consecutive calendar days from the effective date of the written Notice to Proceed to achieve Final Acceptance. Should the Work or any separate part thereof be not completed by such time or date, then the Contractor will pay to the Owner as fixed, agreed and liquidated damages the sum stipulated in the Special Conditions.

IN WITNESS WHEREOF, the parties have executed this Contract on the day and date first above written in 5 original counterparts.

JEFFERSON COUNTY, ALABAMA

ATTEST OF RESOLUTION:

_____ By: _____
President – County Commission of Jefferson County

WITNESS:

_____ By:_____

Title_____
CONTRACTOR

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CERTIFICATE OF SECRETARY OF CORPORATION

I,_____certify that I am the Secretary of the Corporation named as Contractor herein; that_____ _____who signed this Contract on behalf of the Contractor, was then _____ of said Corporation; that said Contract was duly signed for and on behalf of said Corporation by authority of its governing body and is within the scope of its corporate powers.

_____
SECRETARY

(Corporate Seal)

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SECTION 00610

PERFORMANCE BOND

KNOW ALL MEN BY THE PRESENTS, THAT WE _____

hereinafter called the Principal, and _____

hereinafter called the Surety, and held and firmly bound unto Jefferson County, Alabama in the penal sum of _____

_____ dollars($_____)

for payment of which we bind ourselves, our heirs, executors, administrators, successors, and assigns for the faithful performance of a certain written Contract, dated the _____ day of _____, 20___, entered into between the Principal and the Owner for the **2019 PUMP STATION UPGRADES NO. 1 JEFFERSON METROPOLITAN, McADORY, AND COLEMAN LAKES.** A copy of which Contract is incorporated herein by reference and is made a part hereof as if fully copied herein.

NOW THEREFORE, the condition of this obligation is such that if the Principal shall faithfully perform the terms and conditions of the Contract in all respects on his or their part, and shall fully pay all obligations incurred in connection with the performance of such Contract on account of labor and materials used in connection therewith, and all such other obligations of every form, nature, and character, and shall save harmless the Owner from all and any liability of every nature, kind, and character which may be incurred in connection with the performance or fulfillment of such Contract or other such liability resulting from negligence or otherwise on the part of such Principal, and further shall save harmless the Owner from all cost and damage which may be suffered by reason of the failure to fully and completely perform said Contract and shall fully reimburse and repay the Owner for all expenditures of every kind, character, and description which may be incurred by the Owner in making good any and every default which may exist on the part of the Principal in connection with the performance of said Contract; and further that the Principal shall pay all lawful claims of all persons, firms, partnerships, or corporations for all labor performed and materials furnished in connection with the performance of the Contract, and that failure to do so with such persons, firms, partnerships, or corporations shall give them a direct right of action against the Principal and Surety under this obligation, and provided, however, that no suit, action or proceeding by reason of any default whatever shall be brought on this bond after one (1) year from the date on which the final payment on the Contract falls due; and provided further that if any alterations or additions which may be made under the Contract, or in the Work to be done under it, or the giving by the Owner of any extension of time for the performance of the Contract or any other forbearance on the part of either the Owner or the Principal shall not in anyway release the Principal and Surety, or either of them, their heirs, executors, administrators, successors, or assigns from their liability hereunder; notice to the Surety of any such alterations, extensions, or forbearance being expressly waived.

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This obligation shall remain in full force and effect until the performance of all covenants, terms, and conditions herein stipulated and after performance it shall be null and void. Executed in 5 original counterparts.

IN TESTIMONY WHEREOF witness the hands and seals of the parties hereto on the _____

day of _____, 20 ___.

_____
(Signature of Principal)

WITNESS:

_____ By_____

Title _____

_____
(Signature of Surety)

WITNESS:

_____ By_____

Title_____

COUNTERSIGNED:

_____

By_____

Title_____

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SECTION 00611

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, THAT WE _____

hereinafter called the Principal, and _____ hereinafter called the Surety, are held and firmly bound unto Jefferson County, Alabama hereinafter called the Obligee, in the penal sum of _____ dollars, ($_____) lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, personal representatives, successors and assigns, jointly and severally, firmly by these presents:

WHEREAS, said Principal has entered into a certain Contract with said Obligee dated the _____ day of _____, 20___, for the **2019 PUMP STATION UPGRADES JEFFERSON METROPOLITAN, McADORY, AND COLEMAN LAKES,** which Contract and the Drawings and Specifications for said Work shall be deemed a part thereof as fully as if set out herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH that if said Principal and all subcontractors to whom any portion of the Work provided for in said Contract is sublet and all assignees of said Principal and of such subcontractors shall promptly make payments to all persons supplying him or them with labor, materials, feed-stuffs, or supplies for or in the prosecution provided for in such Contract, or in any amendment or extension of or addition to said Contract, and for the payment of reasonable attorneys' fees, incurred by the claimant or claimants in suits of said bonds, then the above obligation shall be void; otherwise to remain in full force and effect. PROVIDED, however that this bond is subject to the following conditions and limitations:

(a) Any person, firm, or corporation that has furnished labor, materials, feed-stuffs, or supplies for or in the prosecution of the Work provided for in said Contract shall have a direct right of action against the Principal and Surety on this bond, which right of action shall be asserted in a proceeding, instituted in the County in which said Principal or Surety does business. Such right of action shall be asserted in a proceeding instituted in the name of the claimant or claimants for his or their use and benefit against said Principal and Surety or either of them (but not later than one year after the final settlement of said Contract) in which action such claims or claim shall be adjudicated and judgment rendered thereon.

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(b) The Principal and Surety hereby designate and appoint JEFFERSON COUNTY, ALABAMA as the Agent of each of them to receive and accept services, processes or other pleading issued or filed in any proceeding instituted on this bond and hereby consent that such services shall be the same as personal service on the Principal and/or Surety.

(c) The Surety shall not be liable hereunder for any damages or compensation recoverable under workman's compensation or employer's liability statute.

(d) In no event shall Surety be liable for a greater sum than the penalty of this bond or subject to any suit, action, or proceeding thereof that is instituted later than one year after the final settlement of said Contract.

SIGNED, SEALED, AND DELIVERED THIS _____ day of _____ 20____, in 5 original counterparts.

_____
WITNESS: (Signature of Principal)

_____ By _____

Title_____

_____
(Signature of Surety)

WITNESS:

_____ By _____

Title _____

COUNTERSIGNED:

By_____
(Resident Agent)

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SECTION 00630

JEFFERSON COUNTY ENVIRONMENTAL SERVICES DEPARTMENT MINORITY BUSINESS ENTERPRISE/DISADVANTAGED BUSINESS ENTERPRISE (MBE/DBE) PROGRAM

A. The Jefferson County Commission Environmental Services Department has adopted a program designed to encourage the participation of MBE/DBEs in construction projects. **THE MBE/DBE FORMS CAN BE FOUND IN APPENDIX C.**

B. All General Contractors are required to submit the following:

1. All Contractors are required to read and sign a statement that they fully understand and will participate in and follow the guidelines and instructions included in this section, JEFFERSON COUNTY ENVIRONMENTAL SERVICES DEPARTMENT MBE/DBE PROGRAM. This statement shall be submitted with the bid documents. Additionally, all Contractors shall submit with the bid documents a list of all MBE/DBE firms submitting proposals. Form "A" (attached) shall be utilized to satisfy this requirement.

2. Prior to award of the Contract, the successful General Contractor is required to submit a list of all MBE/DBE firms the Contractor proposes to utilize during the execution of the Contract (Form "B"). Include with Form "B" any MBE/DBE firms that the major subcontractors propose to utilize. This list must be received by the Environmental Services Department (ESD) prior to contract award by the Commission. The Contract will not be awarded without submission of Forms "A" and "B" (attached).

3. With each monthly pay estimate submitted to the Environmental Services Department, Contractors are required to submit updated monthly MBE/DBE reports which identify any changes in the MBE/DBE firms' utilization, either adds or deducts. Monthly pay estimates will <u>not</u> be processed without the updated list of MBE/DBEs. The Contractor shall use Form "C" (attached) to meet the requirements of this paragraph.

4. Upon completion of the Contract and prior to release of retainage, the General Contractor is required to submit a Project Close-Out Report that includes final accounting of all MBE/DBE firms utilized on the project. The Project Close-Out Report with documented MBE/DBE utilization is a <u>prerequisite</u> for the release of the retainage. The Contractor shall use Form "D" (attached) to meet the requirements of this paragraph.

C. In addition to the requirements of Item B, pre-qualified General Contractors bidding on construction projects for the Environmental Services Department are required to comply with the following:

1. After deciding to bid a project, a prospective bidder must notify the Birmingham Construction Industry Authority (BCIA) of his/her intentions as soon as possible but no less than 5 days before the time set for receiving bids. The Contractor shall complete Form "E" (attached) and submit the completed form to the ESD no later than the scheduled date of the Pre-Bid Conference. This form may be submitted in person at the Pre-Bid Conference. The submission of Form "E" to ESD shall fulfill the notification requirement to the BCIA.

2. The potential prime bidder should obtain the BCIA listing of certified MBE/DBEs to assist in soliciting MBE/DBE participation for the project. The BCIA has advised the County that this listing will be continually monitored and updated by the BCIA. After once receiving the BCIA listing, it will be necessary to only obtain revisions thereafter.

3. In cases of dispute between a MBE/DBE and a General Contractor with respect to whether the MBE/DBE has a low bid, the BCIA Executive Director, with the concurrence of the General Contractor, shall be allowed to view the General Contractor's sub bids, sub analysis sheets, and summary sheets for that specific area of the project. The General Contractor shall not, however, be requested to use a MBE/DBE subcontractor who cannot display reasonable technical and financial qualifications to perform the work in question.

4. Monthly, or as requested by the BCIA, the General Contractor shall furnish data similar to the data being forwarded to ESD under Item B. This information will be accumulated by the BCIA for all participating firms to determine the annual level of business activity in the area. The BCIA is concerned about confidentiality of Contractor reports. This information is intended for use by the BCIA to measure overall minority participation in the Birmingham Metropolitan Area and specifically, in Jefferson County. Every effort will be made to protect the identity of any specific Contractor.

5. After closeout of a specific project, the General Contractor shall submit to the BCIA, a final accounting of the MBE/DBE participation for the project.

END OF SECTION

SECTION 00700

GENERAL CONDITIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Award

B. Contractor's Pre-Start Presentation

C. Starting the Project

D. Qualifications of Subcontractors, Materialmen, and Suppliers

E. Correlation, Interpretation, and Intent of Contract Documents

F. Availability of Lands

G. Subsurface Conditions

H. Differing Site Conditions

I. Supervision and Superintendence

J. Labor, Materials, and Equipment

K. Subcontractors

L. Patent Fees and Royalties

M. Permits

N. Laws and Regulations

O. Safety and Protection

P. Public Convenience and Safety

Q. Sanitary Provisions

R. Indemnifications

S. Work During Inclement Weather

T. Contract Time

U. Liquidated Damages

V. Restoration of Services disturbed by others.

1.2 AWARD

A. The award of the Contract, if it is awarded, will be to the lowest responsible, responsive Bidder. No Notice of Award will be given until the Owner has concluded such investigations as he deems necessary to establish the responsibility, qualifications, and financial ability of the Bidder to do the Work in accordance with the Contract Documents to the satisfaction of the Owner within the time prescribed. The Owner reserves the right to reject the Bid Proposal of any Bidder who does not pass such investigation to the Owner's satisfaction. In analyzing Bid Proposals, the Owner may take into consideration alternates and unit prices, if itemized in the Bid Proposal Form. If the Contract is awarded, the Owner will issue the Notice of Award and give the successful Bidder a contract for execution.

1.3 CONTRACTOR'S PRE-START PRESENTATIONS

A. The Contractor represents that he has familiarized himself with, and assumes full responsibility for having familiarized himself with, the nature and extent of the Contract Documents, Work, locality; and has familiarized himself with all local conditions and federal, state, and local laws, ordinances, rules, and regulations that may in any manner affect performance of the Work; and represents that he has correlated his study and observations with the requirements of the Contract Documents. The Contractor also represents that he has studied all surveys and investigation reports of subsurface and latent physical conditions referred to in the Specifications, and has made such additional surveys and investigations as he deems necessary for the performance of the Work at the Contract Price in accordance with the requirements of the Contract Documents, and has correlated the results of all such data with the requirements of the Contract Documents.

B. Before undertaking each part of the Work, the Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures and drawings shown thereon and all applicable field measurements. He shall at once report in writing to the Engineer any conflict, error, or discrepancy which he may discover.

1.4 STARTING THE PROJECT

A. The Contractor shall start to perform his obligations under the Contract Documents on the date when the Contract Time commences. No Work shall be

done at the site prior to the date on which the Contract Time commences, except with the written consent of the Owner.

1.5 QUALIFICATIONS OF SUBCONTRACTORS, MATERIALMEN, AND SUPPLIERS

A. In accordance with Section 00430 – List of Subcontractors, the Contractor shall submit to the Owner for acceptance as part of the Bid Proposal, a list of the names of the subcontractors and such other persons and organizations (including those who are to furnish principal items of materials or equipment) proposed for those portions of the Work as to which the identity of the subcontractors and other persons and organizations must be submitted. Within ten (10) working days after opening of Bid Proposals, the Owner will notify the Contractor in writing if either the Owner or Engineer, after due investigation, have reasonable objection to any subcontractor, person, or organization on the List of Subcontractors. The failure of the Owner or Engineer to make objection to any subcontractor, person, or organization on the List of Subcontractors within ten (10) days of receipt shall constitute an acceptance of such subcontractor, person, or organization. Acceptance of any such subcontractor, person, or organization shall not constitute a waiver of any right of the Owner or Engineer to reject defective Work, material, or equipment, not in conformance with the requirements of the Contract Documents.

B. The Contractor shall certify that subcontracts have not and will not be awarded to any firm that is currently on the USEPA Master List of Debarred, Suspended, and Voluntarily Excluded Persons.

1.6 CORRELATION, INTERPRETATION, AND INTENT OF CONTRACT DOCUMENTS

A. It is the intent of the Drawings and Specifications to describe completely the project to be constructed in accordance with the Contract Documents. The Contract Documents comprise the entire Agreement between the Owner and the Contractor.

B. The Contract Documents are complementary, what is called for by one is as binding as if called for by all. If the Contractor finds a conflict, error, or discrepancy in the Contract Documents, he shall call it to the Engineer's attention in writing at once and before proceeding with the Work affected thereby. The various Contract Documents shall be given precedence, in case of conflict, error, or discrepancy, as follows: Supplemental General Conditions, Agreement Modifications, Addenda, Special Conditions, Instructions to Bidders, General Conditions, Specifications, and Drawings. If the requirements of other Contract Documents are more stringent than the General Conditions, the more stringent requirements shall apply.

C. The words “furnish”, “furnish and install”, “install”, and “provide” or words with similar meaning shall be interpreted, unless otherwise specifically stated, to mean “furnish and install complete in place and ready for service.”

D. Miscellaneous items and accessories which are not specifically mentioned, but which are essential to produce a complete and properly operating installation, or usable structure or plant, providing the indicated function, shall be furnished and installed without change in the Contract Price. Such miscellaneous items and accessories shall be of the same quality standards, including material, style, finish, strength, class, weight, and other applicable characteristics, as specified for the major component of which the miscellaneous item or accessory is an essential part, and shall be approved by the Engineer before installation. The previously specified requirement is not intended to include major components not covered by or inferable from the Drawings and Specifications.

E. The Work of all trades under this Contract shall be coordinated by the Contractor in such a manner as to obtain the best workmanship possible for the entire project, and all components of the Work shall be installed or erected in accordance with the best practices of the particular trade.

1.7 AVAILABILITY OF LANDS

A. The Owner will furnish, as indicated in the Contract Documents, the lands upon which the Work is to be done, rights-of-way for access thereto, and such other lands which are designated for the use of the Contractor. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by the Owner, unless otherwise specified in the Contract Documents. Other access to such lands or rights-of-way for the Contractor's convenience shall be the responsibility of the Contractor. The Contractor will provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

B. The Owner will, upon request, furnish to the Contractor copies of all available record drawings and subsurface tests.

1.8 SUBSURFACE CONDITIONS

A. The Contractor acknowledges that he has investigated prior to bidding and satisfied himself as to the conditions affecting the Work, including but not restricted to those bearing upon transportation, disposal, handling, and storage of materials; availability of labor, water, electric power, and roads; uncertainties of weather, river stages, tides, water tables, or similar physical conditions at the site; the conformation and conditions of the ground; and the character of equipment and facilities needed preliminary to and during prosecution of the Work. The Contractor further acknowledges that he has satisfied himself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be

encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done on behalf of the Owner on the site or any contiguous site, as well as from information presented in the Drawings and Specifications made a part of this Contract, or any other information made available to him prior to receipt of the Bid Proposals. Any failure by the Contractor to acquaint himself with available information will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the Work. The Owner assumes no responsibility for any conclusions or interpretations made by the Contractor on the basis of the information made available by or through the Owner.

1.9 DIFFERING SITE CONDITIONS

A. The Contractor shall promptly, and before such conditions are disturbed, notify the Owner in writing of:

1. Subsurface or latent physical conditions at the site differing materially from those indicated in this Contract.

2. Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Contract. The Owner shall promptly investigate the conditions, and if he finds that such conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the Work under this Contract, whether or not changed as a result of such conditions, an equitable adjustment shall be made and a change order issued in accordance with Section 01028 – Change Order Procedures.

1.10 SUPERVISION AND SUPERINTENDENCE

A. The Contractor shall supervise and direct the Work. The Contractor shall be solely responsible for the means, methods, the techniques, sequences, and procedures of construction. The Contractor shall employ and maintain on the Work a qualified superintendent who shall have been designated in writing by the Contractor as the Contractor's representative at the site. The superintendent shall have full authority to act on behalf of the Contractor and all communications given to the superintendent shall be as binding as if given to the Contractor. The superintendent shall be present on the site at all times as required to perform adequate supervision and coordination of the Work. Copies of written communications given to the superintendent shall be mailed to the Contractor's home office.

B. All Contractor work groups or crews crossing private property to work in sewer easements shall have at least one individual who can speak English and who is specifically designated to deal with any questions from the property owners

located adjacent to the Work or other members of the public. This person shall be knowledgeable of the Work and capable of answering questions. The designated individual will remain with the crew at all times while work in backyards or on private property is in progress. Questions that cannot be answered shall be forwarded to the Engineer and/or Owner.

1.11 LABOR, MATERIALS, AND EQUIPMENT

A. The Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. The Contractor shall at all times maintain good discipline and order at the site.

B. The Contractor shall furnish all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, local telephone, water and sanitary facilities, and all other facilities and incidentals necessary for the execution, testing, initial operation, and completion of the Work.

C. All materials and equipment shall be new, except as otherwise provided in the Contract Documents. When special makes or grades of material which are normally packaged by the supplier or manufacturer are specified or approved, such materials shall be delivered to the site in their original packages or container with seals unbroken and labels intact.

D. All materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, or processors except as otherwise provided in the Contract Documents.

1.12 SUBCONTRACTORS

A. The Contractor shall perform, with his own forces, the minimum percentage of work for this Project as specified in Section 00820 – Special Conditions.

B. The Contractor shall be fully responsible for all acts and omissions of his subcontractors and of persons and organizations directly or indirectly employed by them, and of persons and organizations for whose acts any of them may be liable to the same extent that he is responsible for the acts and omissions of persons directly employed by him. Nothing in the Contract Documents shall create any contractual relationship between the Owner and any subcontractor or other person or organization having a direct or indirect relationship or contract with the Contractor, nor shall it create any obligation on the part of the Owner to pay or to see the payment of any monies due any subcontractor or other person or organization, except as may otherwise be required by law.

C. The Contractor agrees to bind specifically every subcontractor to the applicable terms and conditions of the Contract Documents for the benefit of the Owner.

D. All Work performed for the Contractor by a subcontractor shall be pursuant to an appropriate agreement between the Contractor and the subcontractor.

E. The Contractor shall be responsible for the coordination of the trades, subcontractors, and materialmen engaged upon his Work.

1. The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the Work to bind subcontractors to the Contractor by the terms of these General Conditions and other Contract Documents insofar as applicable to the Work of subcontractors, and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise of the Contractor under any provisions of the Contract Documents.

2. The Owner or Engineer will not undertake to settle any differences between the Contractor and his subcontractors or between subcontractors.

3. If in the opinion of the Engineer, any subcontractor on the project proves to be incompetent or otherwise unsatisfactory, he shall be replaced by the Contractor if and when directed in writing by the Engineer.

1.13 PATENT FEES AND ROYALTIES

A. The Contractor will pay all license fees and royalties and assume all costs incident to the use of any invention, design, process, or device which is the subject of patent rights or copyrights held by others. He will indemnify and hold harmless the Owner and the Engineer and anyone directly or indirectly employed by either of them from and against all claims, damages, losses, and expenses (including attorneys' fees) arising out of any infringement of such rights during or after completion of the Work, and shall defend all such claims in connection with any alleged infringement of such rights.

B. The Contractor shall be responsible for determining the application of patent rights and royalties on materials, appliances, articles, or systems prior to bidding.

1.14 PERMITS

A. The Contractor will secure and pay for all construction permits and licenses and will pay all governmental charges and inspection fees necessary for the prosecution of the Work. When such charges are normally made by the Owner and when so stated in the Special Conditions, there will be no charges to the Contractor. The Contractor will also pay all public utility charges.

1.15 LAWS AND REGULATIONS

A. The Contractor shall give all notices and comply with all laws, ordinances, rules, and regulations applicable to the Work. If the Contractor observes that the Specifications or Drawings are at variance therewith, he will give the Engineer prompt written notice thereof, and any necessary changes shall be adjusted by an appropriate modification. If the Contractor performs any Work knowing it to be contrary to such laws, ordinances, rules, and regulations, and without such notice to the Engineer, he will bear all cost arising there from.

B. The Contractor shall comply with all laws, ordinances, rules, and regulations of the Alabama Plumbers and Gas Fitters Board.

1.16 SAFETY AND PROTECTION

A. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. He will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury, or loss to:

1. All employees on the Work and other persons who may be affected thereby.

2. All the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site.

3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

B. The Contractor will designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated in writing by the Contractor to the Engineer.

1.17 PUBLIC CONVENIENCE AND SAFETY

A. The Contractor shall, at all times, conduct the Work in such a manner to ensure the least practical obstruction to public travel. The convenience of the general public and of the residents along and adjacent to the area of the Work shall be provided for in a satisfactory manner, consistent with the operation and local condition. "Street Closed" signs shall be placed immediately adjacent to the Work, in a conspicuous position, at such locations as traffic demands. At anytime that streets are required to be closed, the Contractor shall notify law enforcement agencies, fire departments, and parties operating emergency vehicles before the

street is closed and again as soon as it is opened. Access to fire hydrants and other fire extinguishing equipment shall be provided and maintained at all times.

B. All chemicals used during construction or furnished for project operation, including but not limited to herbicides, pesticides, disinfectants, polymers, and reactants, must be labeled to show approval of either USEPA or USDA. Use of all such chemicals and disposal of residues shall be in conformance with the instructions of the applicable state or federal agency.

1.18 SANITARY PROVISIONS

A. The Contractor shall furnish necessary toilet conveniences, secluded from public observation, for use of all personnel on the Work, whether or not in his employ. They shall be kept in a clean and sanitary condition and shall comply with the requirements and regulations of the public authorities having jurisdiction. Sanitary provisions shall commit no public nuisance. Temporary sanitary facilities shall be removed upon completion of the Work and the premises shall be left clean.

1.19 INDEMNIFICATIONS

A. The Contractor will indemnify and hold harmless the Owner and the Engineer and their agents and employees from and against all claims, damages, losses, and expenses including attorneys' fees arising out of or resulting from the performance of the Work, provided that any such claim, damage, loss, or expense is:

1. Attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting there from.

2. Caused in whole or in part by any negligent act or omission of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

B. In any and all claims against the Owner or the Engineer or any of their agents or employees, by any employee of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable. The indemnification obligation shall not be limited in anyway by any limitation on the amount or type of damages, compensation, or benefits payable by or for the Contractor or any subcontractor under workmen's compensation acts, disability benefit acts, or other employee benefit acts.

1.20 WORK DURING INCLEMENT WEATHER

A. Liability for work performed by the Contractor during inclement weather shall be borne exclusively by the Contractor. The Owner or the Engineer shall maintain the ability to suspend the Contractor's work during inclement weather should the Engineer consider suspension to be in the best interest of the Owner. Inferior work performed during inclement weather or work damaged during periods of suspension due to inclement weather shall be repaired and/or replaced by the Contractor. Any time extensions or compensation for repairs or replacement shall be subject to approval by the Engineer.

1.21 CONTRACT TIME

A. The number of days in which the Contractor shall fully perform the proposed Work have been specified in Section 00100 – Notice to Bidders and Section 00820 – Special Conditions. The date of the beginning and the time for completion of the Work are essential conditions of the Contract.

B. In arriving at any credit due the Contractor for extension of time on the Contract, the Owner, upon the recommendation of the Engineer, may allow such credit as, in his judgement, is deemed equitable and just for all delays occasioned by a Change Order, any act, or failure to act, on the part of the Contractor or caused by forces beyond the Contractor's control. Additional time will also be allowed the Contractor to cover approved overruns or additions to the Contract in the same proportion that the said overruns or additions in monetary value bears to the original Contract amount. Delays caused by normal and ordinary weather conditions will not be the basis for an extension of Contract Time.

C. If the Contractor claims that any instructions by the Engineer involve an extension of time, he shall give the Engineer written notice of said claim within ten (10) days after the receipt of such instructions, and in any event before proceeding to execute the Work, stating clearly and in detail the basis of his claim or claims. No such claim shall be valid unless so made.

D. The Contractor shall make no claim for extra compensation due to delays of the project beyond his control. Such delays may include those caused by any act of neglect on the part of the Owner or Engineer, or by any employee of either, or by any separate contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, fire, unusual delays in transportation, adverse weather conditions not reasonably anticipatable, unavoidable casualties, or by delay authorized by the Engineer pending arbitration, or by any other cause which the Engineer determines may justify the delay.

E. Time extensions may be granted upon proper justification by the Contractor. Any claim for time extensions under these provisions shall be submitted in writing to the Engineer not more than ten (10) days following commencement of the delay;

otherwise, claim will be waived. With submission of claim, the Contractor shall provide an estimate of the probable effect of such delay on the progress of the Work.

F. Additional costs incurred in accelerating the Work to compensate for such delays (as previously defined herein) shall also not form the basis for extra compensation claims.

1.22 LIQUIDATED DAMAGES

A. If the Contractor shall fail to complete the Work within the Contract Time, the Contractor will pay to the Owner the amount for liquidated damages as specified in the Special Conditions for each calendar day that the Contractor shall be in default after the time stipulated in the Contract Documents.

1.23 RESTORATION OF SERVICES DISTURBED BY OTHERS

A. The Owner reserves the right to authorize the construction, reconstruction, or maintenance of any public or private utility service, at anytime during the progress of the Work.

B. Except as previously listed herein, the Contractor shall not permit any individual, firm, partnership, or corporation to excavate or otherwise disturb such utility services located within the limits of the Work without the written approval of the Engineer.

C. Should the owner of a public or private utility service be authorized to construct, reconstruct, or maintain such utility service during the progress of the Work, the Contractor shall cooperate with such owner by arranging and performing the work in this Contract so as to facilitate such construction, reconstruction, or maintenance by others whether or not such work by others is part of this contract. When ordered as extra work by the Engineer, the Contractor shall make all necessary repairs to the Work which are due to such authorized work by others, unless otherwise provided for in the Contract, Drawings, or Specifications. It is understood and agreed that the Contractor shall not be entitled to make any claim for damages due to such authorized work by others or for any delay to the Work resulting from such authorized work.

1.24 AGREEMENTS WITH PROPERTY OWNERS

A. Any agreement entered into by the Contractor with any property owner, in connection with construction of this project, must be made in writing and a copy supplied to the Engineer. A written release must also be supplied to the Engineer upon termination of any agreement.

END OF SECTION

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SECTION 00802

NPDES GENERAL PERMIT

PART 1 - GENERAL

1.01 PERMIT APPLICATION

It shall be the responsibility of the Contractor to determine if a State NPDES General Permit ALR100000 for construction site runoff is required as part of this project. When required by the Alabama Department of Environmental Management (ADEM):

A. Contractor shall submit a Notice of Intent (NOI) to be covered under the ADEM National Pollutant Discharge Elimination System (NPDES) General Permit.

1. Application forms and instructions are to be obtained from ADEM.

2. The NOI must be submitted at least 30 days before construction activities begin.

B. Public notice of submittal of the NOI must be published in a local newspaper for one (1) day immediately before submission of the NOI.

C. With the NOI submit a Construction Best Management Practices Plan (CBMPP) and Spill Prevention, Control and Countermeasure (SPCC) Plan.

D. Submit the NOI to:

Director
Alabama Department of Environmental Management
Attn: Water Division
1400 Coliseum Boulevard
Montgomery, Alabama 36110
(Mailing Address)
P.O. Box 301463
Montgomery, Alabama 36130-1463
Telephone (334) 271-7700

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 IMPLEMENTATION

A. Submit three (3) copies (or the number directed by the Engineer) of the NOI to the Engineer for records.

B. Do not begin construction before receiving ADEM acknowledgement of the submitted NOI and approval of coverage of the discharge.

C. Show NOI submittal and ADEM review as an activity on the Project Schedule specified in Section 01310 – Progress Schedules.

D. Comply with all Permit-required inspections, monitoring, documentation, and testing requirements. Submit copies of all Tests, Inspection, Non-Compliance, or other related Reports to the Engineer for records.

END OF SECTION

SECTION 00820

SPECIAL CONDITIONS

PART 1 -- GENERAL

1.01 QUALIFICATIONS OF THE CONTRACTOR

A. The Contractor shall have previous experience in the construction, repair, and rehabilitation of sanitary sewers, force mains, and pump stations; and shall employ workmen and foremen with sufficient knowledge, skill, and experience to perform the work assigned to them.

1.02 CONTRACT TIME

A. The Contract Time for this project is **three hundred sixty-five (365)** consecutive calendar days from the effective date of the written Notice to Proceed to achieve Final Acceptance. The Contractor may apply for an extension of time in accordance with provisions of the Contract; however, such an extension of time must be approved by the Owner prior to the Contract completion date and in accordance with Section 00700 – General Conditions to avoid the imposition of liquidated damages.

B. Extension of the Contract Time may be granted by the Engineer, with approval of the Owner, if the work is on the project's critical path. No extension of time shall be granted to the Contractor for delays occurring to parts of the work that have no specific impact on the critical path as determined by the Owner and Engineer.

C. No extension for Contract Time will be considered for normal weather conditions reasonably anticipated for the area in which the work is being performed. Normal weather conditions shall be defined as the average number of days with precipitation greater than or equal to a trace amount (0.01-inch) for a particular month over a recent 30-year period and shall be based on the 1981-2010 Climate Normals released by the National Oceanic and Atmospheric Administration's National Climactic Data Center for the station located closest to the project site. If the actual number of precipitation days received during any month exceeds the normal precipitation days and more than 50% of the Contractor's work force was affected, the Contractor may be entitled to a Contract extension. If a Contract extension is granted due to weather conditions, the Contract Time shall be extended by the number of days in which actual precipitation exceeded the anticipated precipitation. If the Contractor requests any rain day delays for a particular time period, they must be submitted with the pay request for that time period. No requests for additional days will be granted if not requested at that time.

D. All other requested Contract extensions shall be evaluated by the Owner and Engineer, with their determination deemed final.

1.03 LIQUIDATED DAMAGES

A. The Contractor is advised that TIME IS OF THE ESSENCE on this project. Liquidated damages will be assessed if either the Contract Time to achieve Substantial Completion or the Contract Time to achieve Final Acceptance is exceeded. By executing the Contract, the Contractor agrees to pay as liquidated damages the amount of $1,500.00 per day for each consecutive calendar day after either the Contract Time for Substantial Completion or the Contract Time for Final Acceptance is expired.

1.04 RECORD OF EMPLOYEES

A. The Contractor shall keep an accurate record showing the name, place of residence, citizenship, and per diem pay for each person engaged in the execution of the Contract and shall cause every subcontractor under him, who shall undertake the performance of any part of the Contract, to also keep a similar record of each person engaged in the execution of said subcontract. All such records shall be available at any time to the Owner or his duly authorized representative.

1.05 ARCHEOLOGICAL FINDS

A. Notwithstanding anything to the contrary herein, in the event any archaeological artifacts within the project are discovered during the course of the Work, the Owner shall have and retain all right, title, and interest to such artifacts and shall have the further right, during the course of the Contract, to examine, or cause to have examined, the site of the Work for any such artifacts and to perform, or have performed, archeological excavations and all other related work to explore for, discover, recover, and remove such artifacts from the site of the Work. In the event the archeological examination and related work delays the Contractor's work, he shall be entitled to request an extension of time to complete the Work equal to the number of days he is thus delayed.

1.06 NOTIFICATION TO PROPERTY OWNERS

A. It shall be the responsibility of the Contractor to notify, in writing, any property owner whose service could be affected by the work being performed in the area. Property owner shall be notified a minimum of 48 hours prior to performing any work. The notification shall be on the Contractor’s company letterhead and shall contain the following information:

1. Date

2. Name of Project

3. Description of the type of work
4. Time of construction, including start date and end date

5. Contractor’s Project Manager’s name and phone number

6. Contractor’s Superintendent’s name and phone number

7. Contractor’s Foreman’s name and phone number

8. 24-hour emergency number

B. The Contractor shall be solely responsible for any damage to private service lines or sewer backups caused by the sanitary sewer and manhole replacement work. The Contractor shall provide hotel accommodations for any residents either whose wastewater backs up into their home as a result of the Contractor's work or if use of their sewer service line is limited or prohibited due to the Contractor's operations. Hotel accommodations shall be provided for as long as required to return the resident's home to its original or better condition.

1.07 SAFETY

A. All activities shall be performed in accordance with the manufacturer's recommendations and regulations established by OSHA. Particular attention shall be directed to those safety requirements and regulations involving excavations and entering confined spaces. The Contractor shall provide OSHA-approved access to manholes and other work areas for the Owner and Engineer. The Contractor shall be solely responsible for the safety of this project.

B. If the Owner, Engineer or Resident Project Representative becomes aware of any perceived safety violation, he has the right to inform the Contractor. The provision of, or failure to provide, any such notice to the Contractor shall not be construed as the Owner, Engineer or Resident Project Representative assuming any duty, responsibility or liability for safety precautions and/or programs. The Contractor remains solely responsible for the safety of the project.

1.08 DRUG DETECTION AND DETERRENCE

A. It is the policy of the Owner to achieve a drug-free work force and to provide a workplace that is free from the use of illegal drugs and alcohol. It is also the policy of the Owner that the manufacture, distribution, dispensation, possession, sale, or use of illegal drugs or alcohol by Contractor while on the Owner's premises is prohibited.

1.09 CONTRACT DRAWINGS

A. The Work shall be performed in accordance with the set of Drawings entitled “2019 PS01 – 2019 PUMP STATION UPGRADES NO. 1 JEFFERSON METROPOLITAN, McADORY, AND COLEMAN LAKES” and dated March 2021, which are incorporated herein as part of the Contract Documents and are identified by the following numbers and descriptions:

SHEET NO.	DESCRIPTION	NO. OF SHEETS
01-G001 thru 01-G006	General Drawings	6
05-DT1 thru 05-DT8	Standard Details Drawings	8

10-C100 thru 30-E603	Civil, Process, Structural, and Electrical Drawings	51

1.10 STANDARD DRAWINGS

A. Appendix A of the Specifications and Drawings 05-DT1 thru 05-DT8 present standard drawings prepared by the Engineer to assist the Contractor in the execution of this Contract.

1.11 STORED MATERIALS

A. No payment will be made for stored materials for this Project, unless otherwise approved by the Owner or Engineer.

1.12 PREBLAST SURVEY

A. When the use of explosives is necessary for the prosecution of the Work, the Contractor or his insurer shall conduct a preblast survey.

B. The Contractor shall retain a company specializing in semisonic surveys with at least five (5) years of documented experience.

C. Unless the municipality requires a greater distance, the Contractor's consultant will conduct a preblast survey in strict conformity with all laws, ordinances, and regulations governing blasting and the use of explosives of the surrounding structures within 500 feet of any blasting operation and within 500 L.F. along the ground surface either side of the centerline of the excavation and document their condition prior to beginning construction. It is the Contractor's responsibility to determine the minimum survey distance required by the municipality where the work is being performed. The documentation will include, but is not limited to, written descriptions and photographs of the structures and measures of obvious signs of structural distress such as cracks.

D. Before carrying out the inspection, the Contractor shall notify the Owners of the buildings or structures to be inspected and request permission to carry out the inspection. Should any building Owner refuse permission to carry out this inspection the Contractor shall notify the Engineer in writing, giving the Owner's reason for refusal.

E. The Contractor shall retain a company specializing in explosives for disintegration of rock with at least five (5) years of documented experience.

F. The Contractor will furnish the Owner with a complete copy of said survey prior to initiation of any blasting.

1.13 USE OF EXPLOSIVES

A. The Blasting activities shall be in accordance with ALDOT Standard Specifications for Highway Construction (current version), Article 107.11, Use of Explosives. The blasting contractor and his surety shall indemnify and save harmless Jefferson County, Hazen and Sawyer, and their representatives from all claims for damages arising out of the use, transportation, or storage of explosives.

1.14 SUBCONTRACTORS

A. The Contractor shall perform a minimum of 50 percent of the total value of this Contract utilizing his own forces.

B. All subcontractors performing sewer and manhole replacement work included in this Project shall be pre-qualified by the Jefferson County Environmental Services Department to perform their specific work as classified in Section 00101 – Instructions to Bidders.

C. A list of all subcontractors and the work they will perform must be submitted to the Engineer for approval as part of the Bid Proposal in accordance with Section 00700 – General Conditions. Subcontractors who do not meet pre-qualification requirements to perform their specific work may not perform any Work on the project.

D. No subcontractors will be allowed to perform work on this project without the Contractor's Superintendent on site.

1.15 MANHOLE ENTRY

A. The Contractor shall exercise extreme caution during any manhole entry operations on live sewer lines. Particular attention shall be paid while working on larger diameter sewers. The Contractor shall implement all necessary safety precautions, in accordance with OSHA regulations, to give maximum protection at all times to persons or property at or near the work area.

1.16 CONSTRUCTION RUNOFF PERMITTING

A. The Contractor shall obtain a National Pollutant Discharge Elimination System (NPDES) permit for Storm Water Discharge Associated With Construction Site Runoff if the Contractor determines a NPDES permit is required as part of this project. This permit shall be obtained in accordance with Section 31 32 00 – Slope Protection and Erosion Control. The Contractor shall forward one (1) copy of the permit to the Engineer prior to commencement of work activities.

1.17 UNPERMITTED DISCHARGE PENALTIES

A. In no case shall the discharge of raw sewage be allowed from the sanitary sewer collection system. Any bypassing of raw sewage shall be from one manhole to a downstream manhole in accordance with Section 33 70 00 – Wastewater Flow Control.

B. Any overflows that occur shall be reported to the Engineer. The Owner will file all necessary documents and reports required by the ADEM and USEPA.

C. The unpermitted discharge penalty to the Contractor shall be one thousand dollars ($1,000.00) per day per unpermitted discharge event for days 1-30, five thousand dollars ($5,000.00) per day for days 31-60, and eight thousand dollars ($8,000.00) per day for all days over 60.

D. The Contractor shall owe the unpermitted discharge penalty to the Owner when the Owner reports any unpermitted discharge caused by the actions of the Contractor as an unpermitted discharge to USEPA.

E. The Contractor shall add a line item to the monthly pay estimate for the unpermitted discharge penalty. The line item shall be added to the monthly pay estimate after the first occurrence and shall be maintained on each monthly pay estimate thereafter.

F. The Contractor shall add the penalty to the monthly pay estimate each time an unpermitted discharge report is filed. The penalty shall be added, as would any liquidated damages, as a negative line item to be subtracted from the total amount due to the Contractor that month.

G. The Contractor shall receive final payment in accordance with these documents less any unpermitted discharge penalties incurred.

H. The determination if an unpermitted discharge is caused by the Contractor's actions shall be the sole authority of the Owner.

1.18 ABANDONMENT OF SEWER LINES

A. Where indicated in the Plans or directed by the Engineer, the Contractor shall perform CCTV assessment and/or dyed - water testing to determine whether there are active service connections. The Contractor shall not abandon sewers with an active service connection.

B. The Contractor shall abandon sewers by grouting using a free flowing grout with a 28 - day compressive strength of 1000 psi.

C. Measurement and payment for CCTV assessment performed to determine the presence or absence of active service connections on sewer lines to be abandoned will be on a linear foot basis. Payment shall be made under:

1. CCTV Assessment, per linear foot (size).

D. No separate measurement or payment will be made for dyed-water testing performed to determine the presence or absence of active service connections on sewer lines to be abandoned.

E. Measurement and payment for abandoning sewer lines by grouting will be per linear foot.

1.19 ALABAMA DEPARTMENT OF TRANSPORTATION

A. Appendix B of the Jefferson County Standard Specifications contains the blanket Utility Permit No. 3-1-3982.

B. Any work within the Alabama Department of Transportation right-of-way shall be performed in accordance with the requirements of the Permit. The Alabama Department of Transportation must be notified of and must approve of all work within their right-of-way.

1.20 EXISTING FLOW MONITORS

A. When work is required on manholes that contain existing flow monitors, the flow monitor must be left in-place and shall not be disturbed whatsoever during performance of the Work.

B. If a specific flow monitor must be temporarily removed to perform the work at that existing manhole, Contractor shall be responsible for contacting Cedric Hayden with Jefferson County Environmental Services Department at (205) 214-8611 a minimum of seventy-two (72) hours in advance to coordinate monitor removal.

C. The removal, storage, and reinstallation of any existing flow monitors that require temporary removal must be conducted by ADS, LLC. ADS, LLC will invoice the Owner for the full removal, storage, and reinstallation fees.

1.21 QUANTITIES

A. The Bid Proposal Form may contain quantities for Bid Items that exceed the quantities identified on the Contract Drawings. These quantities may be used to accommodate unforeseen circumstances that may arise during construction.

B. The Bid Proposal Form may contain quantities for Bid Items that underrun the quantities listed on the Bid Proposal Form. Contractor shall make no claim for lost profits due to underrun of Bid Quantities listed on the Bid Form.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

1.22 ALLOWANCES

A. If applicable, any amount listed in the Bid Proposal Form for designated Allowance Items are considered to be part of the Contract Price; however, the use of these funds will follow the procedures set forth in Section 01028 – Change Order Procedures. If the item involves Owner-initiated work, a request for proposal will be issued to the Contractor and, following

receipt and review of the proposal and negotiation of the scope of work and cost, a form for modifying the allowance, as provided by the Owner, will be executed and the Owner will formally notify the Contractor in writing to proceed with the Owner-initiated work. If the work involves the response to eligible unforeseen conditions, the scope of the work and method of payment will be determined by the Engineer following notification by the Contractor and an assessment of the situation.

1.23 PROJECT COMMUNICATION

A. The Contractor shall provide each crew which performs work on this Project with a cell phone at no additional cost to the Owner. A list of contacts and phone numbers for each crew shall be supplied by the Contractor to the Owner and Engineer before beginning any work.

1.24 EXISTING CONDITIONS AND EXISTING UTILITIES

A. The Engineer has attempted to show on the Plans all pertinent surface features and utilities as existed at the time of the survey. The Contractor is urged to view the construction route and to identify any new or overlooked features. Claims for extra work may not be allowed for any feature not shown on the Plans.

B. Only approximate utility locations are shown on the Plans. The Contractor shall be responsible for notifying the appropriate utility company for determining the precise location and having the utility company mark the utility location in the field, and for coordinating his work with the utility company. The Contractor shall notify the utility company a minimum of seventy-two (72) hours in advance of performing any work in the area of the utility. No extra payment shall be made for any deviation from the proposed alignment as shown on the Plans (or increased depth) to avoid existing utilities.

1.25 SERVICE LATERAL CONNECTION AND REPAIR PERMIT

A. Contractor is required to obtain a permit for each service line connection from the Jefferson County Environmental Services Department. The permit must be obtained by a licensed Master Plumber from a company that is licensed by the State of Alabama and has a current Bond with Jefferson County. No fee will be charged to obtain the permit for Jefferson County construction projects. No additional inspections/tests (hydrostatic/wooden ball) will be required other than what is required by the on-site inspector provided to inspect the Jefferson County construction project.

1.26 SERVICE LATERAL RE-ROUTE

A. Service Lateral Re-Route shall consist of required modifications of the service lateral to accommodate connection to a separate sewer main than originally connected. Service lateral installation shall be in accordance with the Jefferson County Environmental Services Department Standard Specifications for Sanitary Sewer Service Lines and Connections.

B. Measurement and Payment for Service Lateral Re-Route shall be made on a linear foot basis. Payment will be full compensation for furnishing all labor, materials, tools, and equipment necessary to perform all work.

1.27 OBSTRUCTIONS WITHIN THE SANITARY SEWER LINE

A. Damage or an obstruction in the sanitary sewer line caused by the Contractor during work within this Contract shall be repaired or removed within 24 hours. If the repair or removal is not performed within the allotted time, the Owner will perform the necessary work at the expense of the Contractor.

1.28 SUBSTANTIAL COMPLETION

A. When the Contractor considers the entire Work to be ready for its intended use, Contractor shall notify Owner and Engineer in writing that he believes Substantial Completion has been achieved, except for items specifically listed by Contractor as incomplete, and request that the Engineer issue a certificate of Substantial Completion. For Substantial Completion to have been achieved, the entire Project must be fully capable of providing its intended use to the satisfaction of the Engineer. "Substantial Completion" means that all portions of the Project shall be installed and operational. All field testing shall be completed; all final paving, grading, and other finish items shall have been completed; and all warranties shall have been submitted and approved. The Contractor's notification shall include an itemized list of remaining incomplete work.

B. Promptly after the Contractor's notification, Owner, Contractor, and Engineer shall perform an inspection of the Work to determine the status of completion. If the Engineer does <u>not</u> consider Substantial Completion of the Work to be achieved, Engineer will notify the Owner and Contractor in writing identifying the particulars in which this determination revealed the Work to be incomplete or defective. If the Engineer does consider Substantial Completion of the Work to be achieved, Engineer will meet with the Contractor to:

1. Prepare a Punch List of incomplete or incorrect items of the Work and establish a date for their completion;

2. Define the division of responsibilities between Owner and Contractor with respect to security, operation, safety, and protection of the Work; maintenance; insurance; and warranties and guarantees; and

3. Describe any other outstanding issues related to Substantial Completion of the Work.

C. Upon reaching agreement with the Contractor, the Engineer will submit a tentative certificate of Substantial Completion to the Owner that states in writing that the Work has achieved Substantial Completion, includes a list of the items to be completed or corrected before final payment, establishes the date for completion of the incomplete or incorrect work, describes

the division of responsibility between the Owner and Contractor, and sets forth any other items related to acceptance. Owner shall have seven days after receipt of the tentative certificate to issue a written objection to Engineer regarding any provisions of the certificate or attached list. If, after considering such objections, if any, Engineer concludes that the Work has not achieved Substantial Completion, Engineer will, within fourteen days after submission of the tentative certificate to the Owner, notify Contractor in writing, stating the reasons why. If, after consideration of Owner's objections, if any, Engineer considers the Work to have achieved Substantial Completion, Engineer will, within said fourteen days, execute and deliver to the Owner a definitive certificate of Substantial Completion, including a revised tentative list of items to be completed or corrected, that has been revised to reflect changes from the tentative certificate that the Engineer believes are justified after consideration of the Owner's objections, if any.

D. The Owner, who has sole discretion for final determination of definitive Substantial Completion, will review the Engineer's definitive certificate that Substantial Completion has been achieved, and if the Owner concurs with that certification, the Owner will notify the Contractor, in writing, that the Work has achieved Substantial Completion. Substantial Completion will not occur until the entire Project is ready for possession and use. The Owner's acceptance notice will include a Punch List of remaining incomplete or incorrect work items, establish the date for their completion, confirm the division of responsibilities between the Owner and Contractor, and describe any other outstanding terms of acceptance. The Contractor will acknowledge receipt of the acceptance notice in writing, indicating acceptance of all of its terms and provisions.

E. Upon receipt of the Contractor's acknowledgement letter, the Owner shall take possession of the Work and put it into its intended service. The date that the Work is put into service will become the date of Substantial Completion. Unless otherwise specified, warranties will begin on the date of Substantial Completion.

F. Upon attainment of Substantial Completion, the Contractor shall become eligible for payment of retainage, subject to a withholding of 200 percent of the value of the outstanding Work, including Punch List items, as determined by the Engineer.

1.29 FINAL ACCEPTANCE

A. Once the Contractor has achieved Substantial Completion as detailed in Article 1.22 herein and has completed the itemized Punch List of the remaining incomplete or incorrect items of the Work from the Owner's notice to the Contractor of acceptance of Substantial Completion, Contractor shall notify Owner and Engineer in writing that he believes Final Acceptance has been achieved and request that the Engineer issue a certificate of Final Acceptance. To achieve Final Acceptance, Contractor shall have removed all of his equipment, materials, tools, trash, labor, etc. from the site of the Work, shall have cleaned the site of the Work to the Owner's satisfaction, and shall have complied with any and all additional requirements for Final Acceptance as listed in the Contract Documents.

B. Promptly after the Contractor's notification, Owner, Contractor, and Engineer shall perform an inspection of the Work to determine the status of acceptance. If the Engineer does not consider Final Acceptance to be achieved, Engineer will notify the Owner and Contractor in writing identifying the particulars in which this determination revealed the Work to be incomplete or defective. If the Engineer does consider the requirements of Final Acceptance to be met, Engineer will execute and deliver to the Owner a definitive certificate of Final Acceptance.

C. The Owner, who has sole discretion for final determination of definitive Final Acceptance, will review the Engineer's definitive certificate that Final Acceptance has been achieved, and if the Owner concurs with that certification, the Owner will notify the Contractor, in writing, that the Work has achieved Final Acceptance.

D. Upon attainment of Final Acceptance, the Contractor shall become eligible for final payment, including any retainage being withheld after Substantial Completion was achieved. Once Final Acceptance is granted to the Contractor, the Owner shall become responsible for all security, operation, safety, and protection of the Work, maintenance, and insurance that were formerly the responsibility of the Contractor prior to achieving Final Acceptance.

1.30 TERMINATION OF THE CONTRACT

A. Upon seven (7) days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, elect to terminate the Agreement. In such case, Contractor shall be paid (without duplication of any items) for:

1. Completed and acceptable work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit directly on such work

2. Expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted work, plus fair and reasonable sums for overhead and profit directly on such expenses

3. Reasonable expenses directly attributable to termination (demobilization)

B. Contractor shall not be paid on account of loss of anticipated profits or revenue or extended overhead or interest or underutilization of personnel or economic loss whatsoever arising out of or resulting from such termination.

1.31 CLEARING OF SANITARY SEWER EASEMENT

A. Furnishing all labor, equipment, and materials for clearing of sanitary sewer easement to access a sanitary sewer and/or manhole shall be considered incidental to the sewer and manhole replacement work. The clearing of the sanitary sewer easement shall be the

minimum necessary for the Contractor to access the sewer line and/or manhole with all necessary vehicles and equipment needed for replacement. After completing the Work, the Contractor shall remove all debris, construction materials, and equipment from the site and shall restore the entire construction area to a clean, neat, and serviceable condition in accordance with the requirements of Section 31 70 00 – Final Grading and Landscaping.

1.32 ACQUISITION OF ADDITIONAL RIGHT-OF-WAY

A. Additional right-of-way may have been acquired for the sanitary sewer work. Any acquired permanent right-of-way and/or temporary construction easement shall be indicated on the Issued for Construction drawings. If right-of-way has not been acquired for the work, the Contractor shall determine the most practical means to gain access to each area where any sanitary sewers and manholes to be replaced are located and shall receive approval of these means from the Owner and Engineer. In these cases, the Contractor shall be responsible for negotiating temporary right-of-entry agreements with any property owner(s).

1.33 TEMPORARY ACCESS ROAD CONSTRUCTION

A. Temporary access road construction shall consist of furnishing all labor, equipment, and materials required to construct a temporary access road. Temporary access road surface shall consist of 6 inches of 2.5-inch to 3.5-inch diameter coarse aggregate backfill. All components of the temporary access road, including, but not limited to, excavation, geotextiles, stone backfill, erosion and sedimentation control, and restoration, shall be considered incidental to the Work with no additional payment.

B. The following Sections of the Specifications shall be used as references in the construction of the temporary access road.

1. Section 02200 – Earthwork

2. Section 02207 – Aggregate Materials

3. Section 31 32 00 – Slope Protection and Erosion Control

4. Section 31 70 00 – Final Grading and Landscaping

1.34 GOVERNING LAW/DISPUTE RESOLUTION

A. The parties agree that this Contract is made and entered into in Jefferson County, Alabama and that all services, materials, and equipment to be rendered pursuant to said Agreement are to be delivered in Jefferson County, Alabama. The interpretation and enforcement of this Agreement will be governed by the laws of the State of Alabama, without giving effect to the conflict of laws rules thereof. The parties agree that jurisdiction and venue over all disputes arising under this Agreement shall be in the Circuit Court of Jefferson County, Alabama, Birmingham Division.

1.35 ASSIGNMENT

A. No portion of this Contract may be sold, assigned, or transferred to a third party without the express written consent of the Owner, its successors, assigns, or designees. Any attempt to assign this Contract without the written consent of the Owner, its successors, assigns, or designees is null and void.

1.36 GENERAL CODE OF THE CITY OF BIRMINGHAM, 1980

A. The Contractor shall adhere to Ordinance No. 10-115 as it relates to Title 4, "Municipal Services", Chapter 5, "Streets and Sidewalks" Article H, "Excavations", of the General Code of the City of Birmingham, 1980 when performing work within the City of Birmingham. A copy of said Ordinance is attached as Appendix F.

1.37 CONTRACTOR OVERTIME

A. Contractor (and Subcontractor) regular working hours consist of up to ten (10) working hours within an 11-hour period between 7:00 a.m. and 6:00 p.m. on a regularly scheduled basis, excluding Sundays and holidays. Overtime work is work in excess of forty (40) hours per week.

B. The Contractor shall compensate the Engineer(s), Engineer's Subconsultant(s), and the Resident Project Representative(s) for overtime work caused by the Contractor or his Sub-Contractor(s). The Owner shall evaluate what constitutes as overtime and their determination shall be final. Compensation shall be based on the following maximum rates:

1. Engineer: up to $150/hour
2. Resident Project Representative: up to $120/hour

1.38 CONTRACTOR'S RESPONSIBILITY FOR WORK:

A. Until final acceptance of the Work by the Owner as evidenced by approval of the final estimate, the Work shall be in the custody and under the charge and care of the Contractor and he shall take every necessary precaution against injury or damage to any part thereof by the action of the elements or from any other cause, whether arising from execution or from non-execution of the Work, unless otherwise provided for elsewhere in the Specifications or Contract.

B. The Contractor shall rebuild, repair, restore and make good, without extra compensation, all injuries or damage to any portion of the Work occasioned by any of the above causes before its completion and acceptance, and shall bear the expenses thereof. In case of suspension of the Work from any cause whatever, the Contractor shall be responsible for all materials and equipment and shall properly store them, if necessary, and shall provide suitable shelter from damage and shall erect temporary structures where necessary.

1.39 PROJECT IDENTIFICATION SIGNAGE

A. The Contractor shall furnish and install one (1) project identification sign no later than ten (10) days after the issuance of the Notice to Proceed, but prior to the commencement of any construction activities. The sign shall be erected at a location of high public visibility adjacent to the main entrance to the site. This sign shall remain the property of the Contractor during construction until the Certificate of Substantial Completion is executed by all parties. No additional compensation is provided for the sign.

1. a. Project identification sign shall be as shown on the following page.
   b. Name of Project: 2019 Pump Station Upgrades No. 1 Jefferson Metropolitan, McAdory, and Coleman Lakes
   c. Commissioner: James A. (Jimmie) Stephens, District 3
   d. Projected Completion: FALL 2022

B. The project identification sign surface shall be installed plumb and level. The Contractor shall erect structurally adequate supports and framing on a secure foundation, rigidly braced and framed to resist wind loadings.

C. Sign finishes shall be adequate to withstand weathering, fading and chipping for the duration of construction. The sign shall be freshly painted using two coats of exterior quality paint and primers, and neatly lettered as shown on the following page. Rough hardware shall be galvanized.

D. After the project is completed, the Contractor shall remove the project information sign, framing, supports and foundations and restore the area to original or better condition.

ASSET MANAGEMENT PROGRAM

Hazen

JEFFERSON COUNTY COMMISSION

JAMES A. (JIMMIE) STEPHENS - PRESIDENT
LASHUNDA SCALES SHEILA TYSON
T. JOE KNIGHT STEVE AMMONS

2019 PUMP STATION UPGRADES NO. 1 JEFFERSON METROPOLITAN, MCADORY, AND COLEMAN LAKES
JAMES A. (JIMMIE) STEPHENS, DISTRICT 3
PROJECTED COMPLETION: FALL 2022

GENERAL CONTRACTOR'S NAME
GENERAL CONTRACTOR'S ADDRESS
GENERAL CONTRACTOR'S ADDRESS
AND PHONE NUMBER

ENGINEER - GARVER
PHONE: (205) 443-3080

ENVIRONMENTAL SERVICES DEPARTMENT
PHONE: (205) 325-5496

"Putting Your Sewer Rate Dollars to Work to Protect Jefferson County's Water Quality and Provide Exceptional Service"

1. Project Sign to be made from ¾"x4'x8' grade-A, Exterior Plywood or 4'x8' Aluminum Composite.
2. Lettering to be painted Black. Lettering, Placards and Outside trim to be painted White.
3. Area surrounding Placards to be painted Blue.
4. Sign to be attached to 4"x4"x8' treated posts painted white.
5. Sign to be maintained in good condition until completion of project.

1.40 POLICY RESOLUTIONS

A. WHEREAS, Jefferson County Departments which put out County work for public bidding specify that the Bid Proposals must be received at a specified place by a specified time at the County Courthouse on the day for opening Bid Proposals, and WHEREAS, the County Commission understands that allowing a bidder to submit a Bid Proposal after the specified time may result in some unfair advantage to the bidder by allowing the bidder more time to obtain quotes from subcontractors and suppliers, and WHEREAS, the Commission desires to establish a uniform policy with respect to the submission of Bid Proposals after the time specified in the Bid Proposal documents. NOW THEREFORE BE IT RESOLVED BY THE JEFFERSON COUNTY COMMISSION that the following shall be the POLICY of the County Commission with respect to Bid Proposals submitted after the time stated in Bid Proposal documents.

It is the POLICY of the Jefferson County Commission that no Bid Proposals shall be accepted by the County after the time stated in the Bid Proposal documents for submission of Bid Proposals. In furtherance of this policy:

1. All invitations for sealed competitive Bid Proposals shall expressly include along with the statement of the time for submitting Bid Proposals, words to the effect that,

   "No Bid Proposals shall be accepted after the time stated for receipt of Bid Proposals. This requirement shall not be waived."

2. For Bid Proposals to be received at the County Commission Audience Chambers in the Jefferson County Courthouse in Birmingham and Bessemer, the clock inside the respective Chambers shall be used to determine the time if the clock appears to be set within five minutes of the correct time. If not, the time shall be as determined by the County official or employee who is responsible for receipt and opening of Bid Proposals.

3. The department shall use best efforts to inform prospective bidders of the foregoing POLICY by placing additional written notice thereof on the Bid Proposal documents and by emphasizing the POLICY at the Pre-Bid Proposal Conference.

APPROVED BY THE JEFFERSON COUNTY COMMISSION

DATE: March 6, 1996
MINUTE BOOK: 112
PAGE(S): 403

END OF SECTION

SECTION 00822

INSURANCE REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General

B. Workman's Compensation and Employer's Liability Insurance

C. Comprehensive General Liability Insurance

D. Contractual Liability

E. Comprehensive Automobile Liability Insurance (Owned, Non-Owned, and Hired)

F. Umbrella Excess Liability over All Primary Insurance

G. Property Insurance

H. Special Hazards or Perils

I. Measurement and Payment

1.2 GENERAL

A. The Contractor shall not commence any work on the project until he obtains, at his own expense, all required insurance; and the Contractor shall not, at any time conduct any operations on the project or associated with the project unless such operations are covered by the specified insurance. Such insurance must have the approval of the Owner as to limit, form, and amount. The Contractor shall not permit any subcontractor(s) to commence work on the project until the same insurance coverage requirements have been complied with by such subcontractor(s) with limits to be determined by the Contractor. However, the failure of the subcontractor(s) to carry adequate insurance shall in no way affect the coverage afforded by the Owner by the Contractor's insurance. The insurance coverage shall be maintained throughout the full period of the Contract. Any insurance bearing on adequacy of the performance shall be maintained after completion of project for the full guaranty period.

B. Proof of insurance coverage specified herein shall be furnished to the Director of Environmental Services, Jefferson County Courthouse, 716 Richard Arrington Jr. Boulevard North, A300, Birmingham, Alabama 35203, in the form of copies of the policies. The Owner, however, in lieu of copies of the policies, and at his discretion, may accept certificates issued by the insurance carrier and showing such policies to

be in force for specified periods. The Contractor shall furnish to the Owner, prior to the expiration date of any policy, renewal certificates showing that policies will remain in force throughout the full period of the Contract. The insurance carrier shall be satisfactory to the Owner. No insurance coverage shall be canceled or materially changed without prior written notice having been given to the Owner, and then only after arrangements satisfactory to the Owner have been made to ensure insurance coverage until the project has been completed and accepted. All Contractors in a joint venture shall have insurance coverage through the same company; or, if that is not practical, then the Owner must be furnished an endorsement which allocates primary and secondary payment responsibilities.

C. The Owner, its governing body, its elected officials, employees, and agents and the Engineer shall also be additional named insured in all insurance policies provided by the Contractor and his subcontractor(s) as respects all work performed under this Contract.

D. In the event that the Contractor or his Surety is prevented by law or by charter from naming the Owner, its governing body, its elected officials, employees, and his agents, and the Engineer as insured in the policies providing the coverage listed herein, the Contractor shall purchase and maintain during the life of this Contract an Owner's and Contractor's Protective Liability Insurance Policy in an amount equal to the maximum amount specified under the various coverage including Umbrella Excess Liability over primary insurance; and the named insured in the Owner's and Contractor's Protective Liability Insurance Policy shall be the Owner, its governing body, its elected officials, employees, agents, and the Engineer. The insurance shall protect the Owner and his agents, and the Engineer, from any claim or loss arising from any act of the Contractor or his subcontractors, or any failure to act on the part of the Contractor or his subcontractors, during the performance of work under this Contract.

E. The specified limits and coverage in any of the policies for the various types of insurance shall not be construed as limiting the Contractor's responsibility to provide contractual coverage sufficiently broad so as to ensure the provisions of the Articles of these specifications relating to Indemnity, or limiting the responsibilities of the Contractor as outlined under aforesaid Articles.

F. Nothing contained in these insurance requirements shall be construed as limiting the extent of the Contractor's responsibility for payment of damages resulting from his operation under this Contract.

G. Insurance carried by the Contractor on the Work shall not relieve the Contractor of the responsibility for the protection of all materials and all work until the project has been accepted by the Owner. Any loss, including insurance deductibles surrendered on the project, shall be borne by the Contractor and/or the insurance company providing the coverage for the Contractor; and the Owner shall not be liable for any cost or replacement of lost or damaged work or material.

H. All policies required under this section shall have a 60-day written Notice of Cancellation or material change to coverage clause. All changes shall be reported and addressed to the Risk Manager, Jefferson County Courthouse, 716 Richard Arrington Jr. Boulevard North, Suite A610, Birmingham, Alabama 35203, and to the Director of Environmental Services, 716 Richard Arrington Jr. Boulevard North, Suite A300, Birmingham, Alabama 35203.

1.3 WORKMEN'S COMPENSATION AND EMPLOYER'S LIABILITY INSURANCE

A. Workmen's Compensation and Employer's Liability Insurance shall be in strict accordance with the requirements of the current and applicable Workmen's Compensation Laws of the State of Alabama. The insurance shall cover all of the Contractor's employees employed or associated with the project; and where any part of the Work is subcontracted, the Contractor shall require subcontractor(s) to provide similar Workmen's Compensation and employer's liability insurance for all employees of the subcontractor(s) unless such employees are covered by the protection afforded by the Contractor. In case any class of employees engaged in hazardous work under this Contract is not protected under the Workmen's Compensation Statute, the Contractor shall provide, and shall cause such subcontractor(s) to provide, adequate coverage for the protection of all employees on the project not otherwise protected under applicable provisions of the Statutes relating to Workmen's Compensation and Employer's Liability Insurance. The minimum limits of coverage shall be as follows:

1.	State of Alabama	Statutory
2.	Applicable Federal	Statutory
3.	Employer's Liability	$500,000.00
4.	Voluntary Compensation	Statutory
5.	Broad Form All State Endorsement	
6.	Benefits received by Union Labor Contracts - As Applicable	

1.4 COMPREHENSIVE GENERAL LIABILITY INSURANCE

A. Comprehensive General Liability Insurance shall protect the Contractor and any subcontractor performing work under this Contract from any claims for bodily injury, sickness or disease, death, personal injury, and property damages which may arise either directly or indirectly out of, or in connection with, the performance of Work under this Contract. The Comprehensive General Liability Insurance Coverage shall include: Premises - Operations; Independent Contractor's Protective; Explosion, Collapse, and Underground Property Damage; Broad Form Property Damage;

Contractual Liability (written and oral); and fellow Employee Coverage. The minimum limits of coverage shall be as follows:

1.	Bodily Injury (Includes Personal Injury)	$1,000,000.00 Each Occurrence $2,000,000.00 Annual Aggregate
2.	Property Damage	$1,000,000.00 Each Occurrence $2,000,000.00 Annual Aggregate
	or	
3.	Bodily Injury and Property Damage, Combined Single Limit	$4,000,000.00 Annual Aggregate (where applicable)

1.5 CONTRACTUAL LIABILITY

A. The minimum limits of coverage shall be as follows:

1.	Bodily Injury	$1,000,000.00 Each Occurrence
2.	Property Damage	$1,000,000.00 Each Occurrence
3.	Annual Aggregate	$2,000,000.00

1.6 COMPREHENSIVE AUTOMOBILE LIABILITY INSURANCE (OWNED, NON-OWNED, AND HIRED)

A. Comprehensive Automobile Liability Insurance (Owned, Non-owned, and Hired) shall protect the Contractor and any subcontractor performing work under this Contract from any claims for bodily injury, death, and property damage which may arise either directly or indirectly out of, or in connection with, the performance of work under this Contract. The minimum limits of coverage shall be as follows:

1.	Bodily Injury	$1,000,000.00 Each Occurrence
2.	Property Damage	$1,000,000.00 Each Occurrence
	or	
3.	Bodily Injury and Property Damage	$2,000,000.00 Each Occurrence

1.7 UMBRELLA EXCESS LIABILITY OVER ALL PRIMARY INSURANCE

A. The minimum limits of coverage shall be as follows:

1. Each Occurrence $5,000,000.00

2. Aggregate (where applicable) $5,000,000.00

1.8 PROPERTY INSURANCE

A. Unless otherwise specified, the Contractor shall provide All Risk Course of Construction Insurance (excluding floods and earthquakes) to cover the interests of all Contractor and subcontractors of any tiers. The Contractor and subcontractors of any tiers shall be responsible for all risks of physical loss to the Work.

1. The total amount of the insurance shall be the amount of the Contract.

2. The policy or policies shall be endorsed to waive all rights of subrogation among, between, and to each insured under the policy or policies. The waiver, however, shall apply only to the policy, or policies, and not to another part or parts of this Contract.

3. Any claim coming under the terms and conditions of the policy or policies, shall be immediately reported to the Engineer.

1.9 SPECIAL HAZARDS OR PERILS

A. The Liability and Property Damage Insurance Coverage of the Contractor's operations shall provide adequate protection against any death, any bodily injury, or any property damage resulting from the blasting operations in connection with the Contractor's work, or in connections with the work of his subcontractors.

1.10 MEASUREMENT AND PAYMENT

A. The cost of insurance required herein shall be included in the unit prices bid on other Bid Proposal items, and no additional amount will be paid.

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SECTION 00825

ALABAMA LAW

AN ACT

Alabama Code Section 39-2-14

(a) Every nonresident Contractor, as defined in Section 39-2-12 of the Code of Alabama 1975, shall register with the Department of Revenue prior to engaging in the performance of a Contract in this state. At the time of registration, the Contractor shall deposit with the Department of Revenue five per centrum (5%) of the amount such Contractor is to receive for the performance of the Contract which shall be held within a "Contractors Use Tax Fund" pending the completion of the Contract, the determination of the taxes due this state and other governmental bodies, and the payment of same. In lieu of such deposit, the Contractor may provide a corporate surety bond to be approved by the Commissioner of Revenue as to form, sufficiency, value, amount, stability, and other features necessary to provide a guarantee of payment of the taxes due this state and other governmental bodies.

(b) In addition, within thirty (30) days after registration, the Contractor shall file a statement with the Department of Revenue itemizing the machinery, materials, supplies, and equipment that he has or will have on hand at the time he begins the fulfillment of the Contract where such tangible personal property has been brought, shipped, or transportation from outside the State of Alabama upon which neither the use taxes or ad valorem taxes have been paid and shall pay the tax due thereon at the time of filing and thereafter shall report and pay the tax as required by the Commissioner of Revenue.

(c) Upon payment of the said taxes due, as required hereby, the deposit or the surety bond required herein shall be returned forthwith to the out-of-state Contractor posting same.

(d) The Commissioner of Revenue shall have authority to promulgate rules and regulations to carry out the provisions of this Act.

ALABAMA LAW

Alabama Code Section 39-3-5

Preference to resident contractors in letting of certain public contracts.

(a) In the letting of public Contracts in which any state, county; or municipal funds are utilized, except those Contracts funded in whole or in part with funds received from a federal agency, preference shall be given to resident Contractors, and a non-agency, preference shall be given to resident Contractors, and a non-resident bidder domiciled in state having laws granting preference to local Contractors shall be awarded Alabama public Contracts only on the same basis as the non-resident bidder's state awards Contracts to Alabama Contractors bidding under similar circumstances; and resident Contractors of Alabama, as defined in Section 39-2-12, Code of Alabama 1975, be they corporate, individuals, or partnerships, are to be granted preference over non-residents in awarding of the Contracts in the same manner and to the same extent as provided by the laws of the state of domicile of the non-resident.

(b) A summary of this law shall be made a part of the advertised specifications of all projects affected by this law.

ALABAMA LAW

Alabama Code Section 31-13-9.

By signing this contract, the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the State of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom.

Alabama Act 2016-312

Contractor certifies that it is not currently engaged in, and for the duration of this agreement will not engage in, the boycott of a person or an entity based in or doing business with a jurisdiction with which this state enjoys open trade.

END OF SECTION

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SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Work to be done under this Contract and in accordance with these Specifications and Drawings consists of furnishing all equipment, superintendence, labor, skill, material, and all other items necessary for the construction of the 2019 Pump Station Upgrades No. 1 – Jefferson Metropolitan, McAdory, and Coleman Lakes, including, but not limited to, all civil, mechanical, structural, electrical, and appurtenant work, complete in-place, tested, and ready for full operation, including temporary facilities as required, all in conformance with the Contract Documents and as directed by the Engineer.

The Contractor shall perform all work required for such construction in accordance with the Contract Documents and subject to the terms and conditions of the Contract, complete and ready for use.

B. The major items of the Work to be performed under this Contract include:

1. Mobilization and demobilization in accordance with Section 01505 – Mobilization and Demobilization

2. Demolition of existing Jefferson Metropolitan Pump Station and construction of new triplex, submersible pump station in its place. The work will include construction of a new wet well and valve vault, installation of pumps, piping, valves, and appurtenances, electrical improvements, and site restoration including concrete paving and fence installation.

3. Refurbishment of existing pumps and wet well at the Coleman Lakes Pump Station. Replacement of grinder and control panel and pump station fencing shall also be performed.

4. Installation of approximately 1670 LF of 6” HDPE force main, fittings, valves, and appurtenances.

5. Demolition of existing McAdory Pump Station and construction of new duplex, suction-lift pump station in its place. The work will include construction of a new pump building, installation of pumps, piping, valves, and appurtenances, electrical improvements, and site restoration including concrete paving and fence installation.

6. Traffic control and regulation as required in accordance with Section 01570 – Traffic Regulation

7. All work necessary, including bypass pumping if required, to temporarily remove portions of the existing sanitary sewer system from operation and divert wastewater flows around construction activities to perform the previously-listed work in accordance with Section 33 70 00 – Wastewater Flow Control

8. Installation, maintenance, and removal of erosion, sedimentation, and pollution control devices in accordance with Section 31 32 00 – Slope Protection and Erosion Control

9. Incidental work associated with each of the previously-listed items of work

10. The estimated quantities of the previously-listed features of the Work shall be as stated in Section 00300 – Bid Proposal.

C. The Project site (site of the Work) is located in various locations throughout McCalla, Alabama as shown on General Drawing 01-G006 and as detailed on Civil Drawings 10-C100 through 30-C103.

D. The foregoing descriptions shall not be construed as a complete description of all work required. All appurtenances related to the work as previously described herein shall also be provided.

E. All Work shall be in compliance with all federal, state, county, and local codes and regulations, standards, and specifications as applicable at the time of Bid unless otherwise directed in writing by the Owner.

1.2 CONTRACT DOCUMENTS

A. The Work to be done is shown on the set of Drawings entitled "2019 PS01 – 2019 PUMP STATION UPGRADES NO. 1 JEFFERSON METROPOLITAN, McADORY, AND COLEMAN LAKES" and dated March 2021. The numbers and titles of all Drawings appear on the Index of Drawings on Drawing 01-G002 – Index Sheet. All Drawings so enumerated shall be considered an integral part of the Contract Documents as defined herein.

B. Certain Document Sections refer to Divisions of the Contract Specifications. Sections are each individually numbered portions of the Specifications (numerically) such as 08110, 13182, 15206, etc. The term Division is used as a convenience term meaning all Sections within a numerical grouping. Division 16 would thus include Sections 16000 through 16903.

C. Where references in the Contract Documents are made to Contractors for specific disciplines of work (i.e. Electrical Contractor, etc.), these references shall be interpreted to be the single prime Contractor when the project is bid or awarded as a single prime contract.

D. The intent of the Drawings and Specifications is to prescribe a complete Work which the Contractor undertakes to perform in full compliance with the Contract. The Contractor shall perform all Work as shown on the Drawings and described in the Specifications and in other parts of the Contract Documents and shall do such additional extra and incidental work as may be considered necessary to complete the Work in a satisfactory and acceptable manner. Any work or material not shown on the Drawings or described in the Specifications, but which may be fairly implied as included in any Bid Item of the Contract, shall be performed and/or provided by the Contractor without additional charges to the Owner. The Contractor shall furnish all labor, materials, tools, equipment, and incidentals necessary to the prosecution and successful completion of the Work.

1.03 GENERAL ARRANGEMENT

A. Drawings indicate the extent and general arrangement of the work. If any departures from the Drawings are deemed necessary by the Contractor to accommodate the materials and equipment he proposes to furnish, details of such departures and reasons therefore shall be submitted as soon as practicable to the Engineer for approval. No such departures shall be made without the prior written approval of the Engineer. Approved changes shall be made without additional cost to the Owner for this work.

B. The specific materials and equipment proposed for use by the Contractor on the project may require changes in structures, auxiliary equipment, piping, electrical, mechanical, controls, or other work to provide a complete satisfactory operating installation. The Contractor shall submit to the Engineer, for approval, all necessary drawings and details showing such changes to verify conformance with the overall project requirements and operating performance. The Bid Price shall include all costs in connection with the preparation of new drawings and details and all changes to construction work to accommodate the proposed materials and equipment.

1.04 CONSTRUCTION PERMITS

A. The Contractor shall obtain, keep current, and pay all fees for any necessary construction permits from those authorities, agencies, or municipalities having jurisdiction over land areas, utilities, or structures which are located within the Contract limits and which will be occupied, encountered, used, or temporarily interrupted by the Contractor's operations unless otherwise stated. Record copies of all permits shall be furnished to the Owner and Engineer.

1. When the Work includes excavating within the limits of a street located in the City of Birmingham, the Contractor shall obtain a Street Excavation (Private) Permit from the City of Birmingham Department of Planning, Engineering & Permits. The current version of the application form for this Permit is located at http://www.birminghamal.gov/download/building_permits_/Street Excavation Private Contractor Application.pdf.

B. When construction permits are accompanied by regulations or requirements issued by a particular authority, agency, or municipality, it shall be the Contractor's responsibility to

familiarize himself and comply with such regulations or requirements as they apply to his operations on this Project.

1.05 ADDITIONAL ENGINEERING SERVICES

A. In the event that the Engineer is required to provide additional engineering services as a result of substitution of materials or equipment by the Contractor which are not "or equal", or changes by the Contractor in dimension, weight, power requirements, etc., of the materials, equipment, and accessories furnished, or if the Engineer is required to examine and evaluate any changes proposed by the Contractor for the convenience of the Contractor, then the Engineer's charges in connection with such additional services shall be charged to the Contractor by the Owner.

B. Structural design shown on the Contract Drawings is based upon typical weights for major items of equipment as indicated on the Contract Drawings and specified. If the equipment furnished exceeds the weights of said equipment, the Contractor shall assume the responsibility for all costs of redesign and for any construction changes required to accommodate the equipment furnished, including the Engineer's expenses in connection therewith.

C. In the event that the Engineer is required to provide additional engineering services as a result of Contractor's errors, omissions, or failure to conform to the requirements of the Contract Documents, or if the Engineer is required to examine and evaluate any changes proposed by the Contractor solely for the convenience of the Contractor, then the Engineer's charges in connection with such additional services shall be charged to the Contractor by the Owner.

1.06 ADDITIONAL OWNER'S EXPENSES

A. In the event the Work of this Contract is not completed within the time set forth in the Contract or within the time to which such completion may have been extended in accordance with the Contract Documents, the additional engineering or inspection charges incurred by the Owner may be charged to the Contractor and deducted from the monies due him. Extra work or supplemental Contract work added to the original Contract, as well as extenuating circumstances beyond the control of the Contractor, will be given due consideration by the Owner before assessing engineering and inspection charges against the Contractor.

B. Unless otherwise specifically permitted, the normal time of work under this Contract shall be as specified in Section 01015 – Prosecution and Progress. Work beyond these hours will result in additional expenses to the Owner. Any expenses and/or damages, including the cost of the Owner’s inspector and/or other onsite personnel who are normally employed as part of the Work, arising from the Contractor's operations beyond the hours and days specified in Section 01015 – Prosecution and Progress shall be borne by the Contractor.

C. Charges assessed to the Contractor for additional engineering and inspection costs will be determined based on actual hours charged to the job by the Owner. Daily rates will depend on the number, classifications, and salaries of employees involved, but in no case shall such charges exceed $960 per day for field personnel and $1,210 per day for engineering personnel, based on an 8-hour workday.

D. Charges for additional Owner's expenses shall be in addition to any liquidated damages assessed in accordance with the Contract.

1.07 SURVEYS AND LAYOUT

A. All work under this Contract shall be constructed in accordance with the lines, grades, and elevations shown on the Drawings or as directed by the Engineer or Owner. Existing conditions (i.e. elevations and locations of existing ground surfaces, structures, equipment, piping, etc.) shown on the Drawings were derived from the best available information at the time of their preparation and are believed to be reasonably correct but are not guaranteed to be absolute; therefore the existing conditions presented shall be considered only as an approximation. The Contractor shall perform any and all field surveys at his/her expense that he/she deems necessary to verify the actual details and conditions of the existing facility prior to submitting his/her Bid, upon which his/her Bid shall be based.

1. No attempt has been made to locate vertical bends or horizontal bends in existing piping.

B. The Work and its connections, routing, and design intent are based on the information currently available showing the existing conditions. The Contractor shall field-verify the nature and extent of the Work prior to ordering any materials. No payment shall be authorized for materials not retained as part of the Owner’s sewage facilities and appurtenances.

C. All survey, layout, and measurement work for establishing horizontal and vertical control points to be used as baselines for construction control purposes shall be performed by the Contractor at his expense as a part of the Work. The Contractor shall provide a Licensed Surveyor as Chief of Party, an experienced instrument person, competently qualified men as assistants, and all necessary instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement work. In addition, Contractor shall furnish, without additional charge, competent persons and such instruments, tools, stakes, and other materials as Engineer may require in checking survey, layout, and measurement work performed by Contractor.

D. Contractor shall establish all horizontal and vertical baselines for the location of the principal component parts of the Work together with a suitable number of benchmarks and batter boards adjacent to the Work. Based upon the information provided by the Contract Drawings, the Contractor shall develop and make all detail surveys necessary for construction, including slope stakes, batter boards, stakes for all working points, lines, and elevations.

E. Contractor shall have the responsibility of carefully preserving and protecting the benchmarks, reference points, and stakes from damage, and in the case of destruction thereof by the Contractor or resulting from his negligence, the Contractor shall be charged with the expense and damage resulting therefrom and shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such benchmarks, reference points, and stakes, including removing and reconstructing work which is improperly located.

F. Existing or new control points, property markers, and monuments that will be or are damaged or destroyed during the normal course of construction operations shall be reestablished and replaced by the Contractor, and all reference ties recorded therefore shall be furnished to the Engineer. If Contractor needs to relocate any existing or new control points, property markers, or monuments that will be impacted by the construction operations, they shall be relocated to a location on the site which is acceptable to the Owner and Engineer. All computations necessary to establish the exact position of the work shall be made and preserved by the Contractor.

G. The Engineer may check all or any portion of the Work, and the Contractor shall afford all necessary assistance to the Engineer in carrying out such checks. Any necessary corrections to the Work shall be immediately made by the Contractor. Such checking by the Engineer shall not relieve the Contractor of any responsibilities for the accuracy or completeness of his work.

H. At completion of the work, the Contractor shall furnish Record Drawings to the Owner indicating the final layout of all structures, piping, supports, roads, existing benchmarks, etc. in accordance with Section 01300 – Submittals and Section 01720 – Project Record Documents. The Record Drawings shall indicate all critical as-installed elevations and dimensions of piping, supports, structures, finish grades, etc.

1.08 FIRE PROTECTION

A. Contractor shall take all necessary precautions to prevent fires at or adjacent to the work, buildings, etc. and shall provide adequate facilities for extinguishing fires which do occur. Burning shall not be permitted.

B. When fire or explosion hazards are created in the vicinity of the work as a result of the locations of fuel tanks or similar hazardous utilities or devices, the Contractor shall immediately alert the local Fire Marshal, the Engineer, and the Owner of such tank or device. The Contractor shall exercise all safety precautions, shall comply with all instructions issued by the Fire Marshal, and shall cooperate with the Owner of the tank or device to prevent the occurrence of fire or explosion.

1.09 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, or reactant of other classification, must show

approval of either the EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with all applicable rules and regulations.

1.10 FIRST AID FACILITIES AND ACCIDENTS

A. First Aid Facilities

1. The Contractor shall provide at the site such equipment and facilities as are necessary to supply first aid to any of his personnel who may be injured in connection with the work.

B. Accidents

1. The Contractor shall promptly report, in writing, to the Engineer and Owner all accidents whatsoever out of, or in connection with, the performance of the Work, whether on or adjacent to the site, which cause death, personal injury, or property damage, giving full details and statements of witnesses.

2. If death, serious injuries, or serious damages are caused, the accident shall be reported immediately by telephone or messenger to both the Owner and the Engineer.

3. If any claim is made by anyone against the Contractor on account of any accidents, the Contractor shall promptly report the facts, in writing, to the Engineer and Owner, giving full details of the claim.

1.11 ULTIMATE DISPOSITION OF CLAIMS BY ONE CONTRACTOR ARISING FROM ALLEGED DAMAGE BY ANOTHER CONTRACTOR

A. During the progress of the work, other contractors may be engaged in performing other work or may be awarded other Contracts for additional work on this project. In that event, the Contractor shall coordinate the work to be done hereunder with the work of such other contractors and the Contractor shall fully cooperate with such other contractors and carefully fit its own work to that provided under other Contracts as may be directed by the Engineer. The Contractor shall not commit or permit any act which will interfere with the performance of work by any other Contractor.

B. If the Engineer shall determine that the Contractor is failing to coordinate his work with the work of the other contractors as the Engineer directed, then the Owner shall have the right to withhold any payments otherwise due hereunder until the Contractor completely complies with the Engineer's directions.

C. If the Contractor notifies the Engineer in writing that another Contractor is failing to coordinate his work with the work of this Contract as directed, the Engineer will promptly investigate the charge. If the Engineer finds it to be true, he will promptly issue such directions to the other Contractor with respect thereto as the situation may require. The Owner, the Engineer, nor any of their agents shall not, however, be liable for any

damages suffered by the Contractor by reason of the other Contractor's failure to promptly comply with the directions so issued by the Engineer, or by reason of another Contractor's default in performance, it being understood that the Owner does not guarantee the responsibility or continued efficiency of any Contractor.

D. The Contractor shall indemnify and hold the Owner and the Engineer harmless from any and all claims of judgments for damages and from costs and expenses to which the Owner may be subjected or which it may suffer or incur by reason of the Contractor's failure to comply with the Engineer's directions promptly.

E. Should the Contractor sustain any damage through any act or omission of any other Contractor having a Contract with the Owner for the performance of work upon the site or of work which may be necessary to be performed for the proper execution of the work to be performed hereunder, or through any act or omission of a Subcontractor of such Contract, the Contractor shall have no claim against the Owner or the Engineer for such damage, but shall have a right to recover such damage from the other Contractor under the provision similar to the following provisions which have been or will be inserted in the Contracts with such other contractors.

F. Should any other Contractor having or who shall hereafter have a Contract with the Owner for the performance of work upon the site sustain any damage through any act or omission of the Contractor hereunder or through any act or omission of any Subcontractor of the Contractor, the Contractor agrees to reimburse such other Contractor for all such damages and to defend at his own expense any suit based upon such claim and if any judgment or claims against the Owner shall be allowed, the Contractor shall pay or satisfy such judgment or claim and pay all costs and expenses in connection therewith and shall indemnify and hold the Owner harmless from all such claims.

G. The Owner's right to indemnification hereunder shall in no way be diminished, waived, or discharged by its recourse to assessment of liquidated damages as provided in the Contract or by the exercise of any other remedy provided for by Contract Documents or by law.

1.12 BLASTING AND EXPLOSIVES

A. The use of blasting or explosives shall not be allowed under this Project.

1.13 LIMITS OF WORK AREA

A. The Contractor shall confine his construction operations within public properties, rights-of-way, and permanent easements located within the portions of sanitary sewer collection system basins as shown on the Drawings and as approved by the Owner. For any portion of the Work located on private property outside of public properties, rights-of-way, and permanent easements, Contractor shall coordinate with the respective private property owner for accessing those areas. Storage of equipment and materials and/or erection and use of temporary sheds shall be confined to the Owner's property and shall be subject to the Owner's approval. Such storage or temporary structures shall not be placed on

properties designated as easements or rights-of-way unless specifically permitted elsewhere in the Contract Documents.

1.14 WEATHER CONDITIONS

A. No work shall be done when the weather is unsuitable. The Contractor shall take necessary precautions (in the event of impending storms) to protect all work, materials, and equipment from damage or deterioration due to floods, driving rain, wind, and snow storms. The Owner reserves the right, through the opinion of the Engineer, to order that additional protection measures over and beyond those proposed by the Contractor be taken to safeguard all components of the Project. The Contractor shall not claim any compensation for such precautionary measures so ordered, nor claim any compensation from the Owner for damage to the Work from weather elements.

B. The mixing and placing of concrete or pavement courses, the laying of masonry, and installation of sewers and water mains shall be stopped during rainstorms if ordered by the Engineer, and all freshly placed work shall be protected by canvas or other suitable covering in such manner as to prevent running water from coming in contact with it. Sufficient coverings shall be provided and kept ready at hand for this purpose. The limitations and requirements for mixing and placing concrete or laying of masonry in cold weather shall be as described elsewhere in these Specifications.

1.15 PERIODIC CLEANUP: BASIC SITE RESTORATION

A. During construction, the Contractor shall regularly remove from the site of the Work all accumulated debris and surplus materials of any kind which result from his operations. Unused equipment and tools shall be stored at the Contractor's yard or base of operations for the Project.

B. When the work involves installation of sewers, drains, water mains, manholes, underground structures, or other disturbance of existing features in or across streets, rights-of-way, easements, or private property, the Contractor shall (as the work progresses) promptly backfill, compact, grade, and otherwise restore the disturbed area to the basic condition which will permit resumption of pedestrian or vehicular traffic and any other critical activity or functions consistent with the original use of the land. The requirements for temporary paving of streets, walks, and driveways are specified elsewhere. Unsightly mounds of earth, large stones, boulders, and debris shall be removed so that the site presents a neat appearance.

C. The Contractor shall perform the cleanup work on a regular basis and as frequently as ordered by the Owner. Basic site restoration in a particular area shall be accomplished immediately following the installation or completion of the required facilities in that area. Furthermore, such work shall also be accomplished, when ordered by the Owner, if partially completed facilities must remain incomplete for some time period due to unforeseen circumstances.

D. Upon failure of the Contractor to perform periodic cleanup and basic restoration of the site to the Owner's satisfaction, the Owner may, upon five (5) days prior written notice to the Contractor, without prejudice to any other rights or remedies of the Owner, cause such work for which the Contractor is responsible to be accomplished to the extent deemed necessary by the Owner, and all costs resulting therefrom shall be charged to the Contractor and deducted from the amounts of money that may be due him.

E. Engineer and Owner will not approve any Application for Payment if, at the time of approval, the site is not adequately cleaned and/or restored to the Engineer's and Owner's satisfaction.

1.16 USE OF FACILITIES BEFORE COMPLETION

A. The Owner reserves the right to enter and use any portion of the constructed facilities before final completion of the whole work to be done under this Contract. However, only those portions of the facilities which have been completed to the Engineer's satisfaction, as evidenced by his issuing a Certificate of Substantial Completion covering that part of the work, shall be placed in service.

B. It shall be the Owner's responsibility to prevent premature connections to or use of any portion of the installed facilities by private or public parties, persons, or groups of persons, before the Engineer issues a Certificate of Substantial Completion covering that portion of the work to be placed in service.

C. Consistent with the approved progress schedule, the Contractor shall cooperate with the Owner, his agents, and the Engineer to accelerate completion of those facilities, or portions thereof, which have been designated for early use by the Owner.

1.17 CONSTRUCTION VIDEO

A. The Contractor shall video the surface features of the entire project site, including concrete and asphalt roadway and driveway pavements, sidewalk, curb and gutter, fencing, structures, landscaping, etc. located in the immediate areas surrounding the pipes and manholes to be installed or replaced. The original video file shall be submitted to the Engineer prior to beginning construction activities. The video shall be provided as an Audio Video Interleave (.avi) file on DVD-ROM. The video shall clearly identify existing site and structural conditions prior to excavation occurring.

B. Engineer and Owner will not approve the first Application for Payment if the Contractor has not submitted an acceptable construction video.

1.18 INTOXICATING LIQUORS

A. The Contractor shall neither permit nor suffer the introduction or use of intoxicating substances, such as but not limited to alcohol or illegal drugs, upon or about the project site.

1.19 EMERGENCY RESPONSE

A. The Contractor shall respond within four (4) hours to any emergency that may arise in connection with the Work on a twenty-four (24) hour per day, seven (7) days per week basis. Should the Owner's maintenance forces be called upon by the Owner to rectify a problem created by the Contractor, the Contractor shall be responsible for all costs incurred by the Owner, plus twenty-five (25) percent, with a minimum charge of one hundred (100) dollars per occurrence. This charge shall be subject to change depending upon the severity of the emergency and shall be determined by the Owner.

1.20 AVAILABILITY OF CONTRACT DOCUMENTS

A. Contractor shall maintain one (1) complete set of Contract Documents, including both the Drawings and Specifications, onsite at all times during performance of the Work that shall be made available to the Owner upon their request.

1.21 ATTENTION TO WORK

A. The Contractor shall give his personal attention to and shall supervise the Work to the end that it shall be faithfully prosecuted. When Contractor is not personally present on the Work, he shall at all times be represented by a competent superintendent or foreman who shall be present at the Work to receive and obey all instructions or orders given under this Contract. Superintendent or foreman shall have full authority to execute these instructions or orders; supply materials, tools, and labor without delay; and serve as the legal representative of the Contractor. The Contractor shall be liable for the faithful observance of any instructions delivered to him or to his authorized representatives.

1.22 ACCESS TO WORK

A. Contractor shall at all times provide proper facilities for access and inspection of the Work by representatives of the Owner and of such official governmental agencies as may be designated by the Owner as having jurisdictional rights to inspect the Work in accordance with Section 01550 – Site Access and Storage.

PART 2 -- PRODUCTS
(NOT USED)

PART 3 -- EXECUTION
(NOT USED)

- END OF SECTION -

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SECTION 01011
DEFINITIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Definitions of Selected Terms Used in These Specifications

1.02 DEFINITIONS OF SELECTED TERMS USED IN THESE SPECIFICATIONS

A. Wherever the words, forms, or phrases defined or pronouns used in their stead occur in the Specifications, in the Contract, in the Advertisement, or in any document or instrument herein contemplated or to which these Specifications apply, the intent and meaning shall be construed and interpreted as follows:

1. Abbreviations: The following organizations are referred to in these Specifications by the following abbreviations of their titles:

a. AASHTO – American Association of State Highway and Transportation Officials

b. ACI – American Concrete Institute

c. ACIFS – American Cast Iron Flange Standards

d. ADEM – Alabama Department of Environmental Management

e. AFBMA – Anti-Friction Bearing Manufacturers Association

f. AGA – American Gas Association

g. AGMA – American Gear Manufacturers Association

h. AIA – American Institute of Architects

i. AISC – American Institute of Steel Construction

j. AISI – American Iron and Steel Institute

k. ALDOT – Alabama Department of Transportation

l. ANSI – American National Standards Institute

m. API – American Petroleum Institute

n. ASA – American Standards Association

o. ASCE – American Society of Civil Engineers

p. ASHRAE – American Society of Heating, Refrigerating and Air-Conditioning Engineers

q. ASME – American Society of Mechanical Engineers

r. ASTM – American Society for Testing and Materials

s. AWS – American Welding Society

t. AWWA – American Water Works Association

u. CEMA – Conveyor Equipment Manufacturers Association

v. CRSI – Concrete Reinforcing Steel Institute

w. DIPRA – Ductile Iron Pipe Research Association

x. EPA – United States Environmental Protection Agency

y. FDA – United States Food and Drug Administration

z. Fed Spec – Federal Specifications

aa. ICRI – International Concrete Repair Institute

bb. IEEE – Institute of Electrical and Electronic Engineers

cc. IPCEA – Insulated Power Cable Engineers Association

dd. ISO – Insurance Services Offices

ee. NACE – National Association of Corrosion Engineers

ff. NASSCO – National Association of Sewer Service Companies

gg. NBS – National Bureau of Standards

hh. NEC – National Electrical Code

ii. NEMA – National Electrical Manufacturers Association

jj. OSHA – Occupational Safety and Health Administration

kk. PCI – Precast Concrete Institute

ll. SSPC – The Society for Protective Coatings

mm. UL – Underwriters Laboratories, Inc.

nn. USDA – United States Department of Agriculture

oo. USGS – United States Geological Survey

2. Addenda: Any clarification, correction, or change to Drawings and/or Specifications after advertisement for bids has commenced but prior to opening of bids shall be made by addenda, with appropriate supplemental Drawings and/or Specifications issued to all Bidders. After issuance, any addenda shall become a part of the Contract Documents as much as though fully contained therein.

3. Advertisement: A public announcement inviting bids for Work to be performed and materials to be furnished

4. Bid: The offer or Bid Proposal of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed

5. Bid Bond: The approved form of security furnished by the Bidder and his surety, with the Bid Proposal, as a guarantee that the Bidder will enter into an agreement with the Owner for construction of the Work should the Contract be awarded to him

6. Bid Proposal: The written and signed statement of the Bidder submitted on the prescribed form setting forth the prices to perform the contemplated Work and furnish the necessary materials in accordance with the provisions of the Drawings and Specifications

7. Bid Proposal Form: The prescribed form on which the offer of a Bidder is to be submitted

8. Bidder: Any individual, firm, partnership, or corporation submitting a Bid for the advertised Work

9. Calendar Days: Every day shown on the calendar, beginning and ending at midnight, including Sundays and holidays

10. Change Order: A written order to the Contractor covering changes in the Drawings, Specifications, or Bid Proposal quantities and establishing the basis of payment and Contract Time adjustment, if any, for the Work affected by such changes

11. Contract: The written agreement between the Owner and the Contractor covering the performance of the Work

12. Contract Documents: The Contract, including Advertisement for Bids, Bid Proposal, Contractor Performance Requirements, Special Conditions, Technical Specifications, Agreement, Bonds, Drawings, Notice of Award, Notice to Proceed, Addenda, if any, and all approved Change Orders

13. Contract Time: The number of calendar days or working days, stated in the Bid Proposal, allowed for completion of the Contract, including authorized time extensions. If a calendar date of completion is stated in the Bid Proposal in lieu of a number of calendar or working days, the Contract shall be completed by that date.

14. Contractor: The individual, firm, partnership, or corporation selected by the Owner as the successful Bidder, who has become a party to the Contract, and his duly authorized representatives for performance of prescribed Work

15. County: The County of Jefferson, within the State of Alabama, the party of the first part of the Contract, acting by and through the Jefferson County Commission

16. Drawings: The official Contract Drawings or exact reproduction thereof which show and describe the Work to be done and which are to be considered as a part of the Contract, supplementary to the Specifications

17. Employee: Any person working on the project to which these Specifications apply who is under the direction or control of, and receives compensation from, the Contractor or subcontractors

18. Engineer: An authorized agent of the Jefferson County Environmental Services Department assigned to make interpretation and enforcement of the Drawings and Specifications, approve submittals, generally oversee the quality and progress of the Work, and determine the amount, quantity, acceptability, and fitness of the Work as specified in the Drawings and Specifications. In some circumstances, the Owner may elect to act as Engineer on all or a portion of the Project.

19. Equipment: All machinery, together with the necessary supplies for upkeep and maintenance, and all tools and apparatus necessary for the proper construction and acceptable completion of the Work

20. Extra Work: An item of Work not provided for in the awarded Contract as previously modified by Change Order but which is found by the Engineer to be necessary to complete the Work within the intended scope of the Contract as previously modified.

21. Final Acceptance: As defined in Section 00820 – Special Conditions.

22. Inspector: An authorized representative of the Engineer assigned to make all necessary inspections and/or tests of the Work performed or of the materials furnished or being furnished by the Contractor

23. Laboratory: The official testing laboratories of the Owner or such other laboratories as may be designated by the Engineer

24. Mainline Sanitary Sewer: A pipe or conduit which is closed and not flowing full, which is intended to carry only sanitary and industrial wastewater from residences, commercial buildings, industrial parks, and institutions

25. Major and Minor Contract Items: A major Contract item shall be any item that is listed in the Bid Proposal Form, the total cost of which is equal to or greater than ten percent (10%) of the total amount of the awarded Contract. All other items shall be considered minor Contract items.

26. Materials: Any substance specified for use in the Contract Work and its appurtenances

27. Notice of Award: The written notice of the acceptance, by the Owner, of the successful Bidder's Bid Proposal

28. Notice to Proceed: The written notice issued by the Owner to the Contractor authorizing him to proceed with the Contract Work and establishing, when applicable, the date of commencement and termination of the Contract Time

29. Or Equal: Wherever a particular process, material, device, detail, or part is specified herein, followed by these words or by similar or equivalent expressions, such words or expressions shall be understood to mean and permit the use of another process, material, device, or part that the Engineer shall determine is fully equal in suitability, quality, durability, performance, and in all other respects, to the process, material, device, detail, or part herein specified for such use, and shall approve for such use in the Work.

30. Owner: The term Owner shall mean the Jefferson County Commission (Alabama), its successors, assigns, or designees.

31. Partial Utilization: As defined in Section 00820 – Special Conditions

32. Pay Item: A specifically described unit of Work for which a price is provided in the Contract

33. Payment Bond: The approved form of security furnished by the Contractor and his Surety as a guarantee that he will pay in full all bills and accounts for materials and labor used in the construction of the Work

34. Performance Bond: The approved form of security furnished by the Contractor and his Surety as a guarantee that the Contractor will complete the Work in accordance with all Contract Documents

35. Project: The agreed Work to be performed as provided in the Contract

36. Proposal Guaranty: The certified check or Bid Bond furnished with a bid to assure that the Bidder will enter into the Contract if his bid is accepted

37. Resident Project Representative: An authorized representative of the Owner who is assigned to observe the construction of the Work and advise the Owner of the Work's prosecution

38. Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged

39. Sanitary Sewer: A sewer which carries wastewater

40. Sanitary Sewer Overflow (SSO): An SSO shall occur when uncontained wastewater outside the construction work area (that does not drain back into the trench) comes in contact with the ground or is able to reach waters of the State. This may include non-dewatered spoils removed from trench excavation (that does not drain back to the trench) as determined by the on-site inspector. This does include leakage of water from dump trucks and/or excavation equipment traveling on public streets. This also includes overflow of manholes and/or trenches due to contractors work (failure of bypass pumps, inadequate plugs, etc.).

41. Sanitary Sewer Service Lateral: Any pipe connected to a mainline sewer which carries sanitary and industrial wastewater from residences, commercial buildings, industrial facilities, and institutions to the mainline sanitary sewer

42. Shop Drawings: All drawings, diagrams, illustrations, brochures, schedules, and other data which are prepared by the Contractor, a subcontractor, manufacturer, supplier, or distributor, which illustrates how specific portions of the Work shall be fabricated, erected, or installed

43. Special Conditions: Additions and revisions to the Standard Specifications

applicable to an individual project. The Special Conditions are intended to supplement, modify, or delete items covered in the Standard Specifications. Special Conditions shall prevail over General Conditions.

44. Specifications: A part of the Contract Documents containing the written directions, provisions, and requirements for completing the Contract Work. Standards for specifying materials or testing which are cited in the Contract Specifications by reference shall have the same force and effect as if included in the Contract physically.

45. State: The State of Alabama

46. Station: A specific point on the centerline of the sewer or on the survey baseline designating some specific distance from the point of origin. Stations are numbered in terms of one hundred linear feet measured horizontally.

47. Storm Sewer: A sewer which carries surface runoff and subsurface waters

48. Structures: Facilities such as bridges, culverts, catch basins, inlets, retaining walls, cribbing, storm and sanitary sewer lines, water lines, under drains, electrical ducts, manholes, handholes, lighting fixtures and poles, transformers, flexible and rigid pavements, buildings, vaults, and other manmade features that may be encountered in the Work and not otherwise classified herein

49. Subcontractor: An individual, firm, partnership, or corporation, approved by the Owner, having a direct contract with the Contractor for the performance of specified portions of the Contract

50. Substantial Completion: As defined in Section 00820 – Special Conditions

51. Superintendent: The Contractor's representative who is present on the Work during progress, authorized to receive and fulfill instructions from the Engineer, and who shall supervise and direct the construction

52. Supplier: Any individual, firm, partnership, or corporation who sells, rents, or supplies materials or equipment for the proper execution of the Work, including that fabricated to a special design, but who does not perform labor at the site. Establishment of a temporary plant or facility of any kind on or near a project for the purpose of furnishing material for that project only will not be considered a "Supplier" but will be considered a "Subcontractor" as defined in these Specifications, unless such plant is established and operated by the Contractor.

53. Surety: The individual, firm, partnership, or corporation, other than the Contractor, executing Bid, Payment, or Performance Bonds which are furnished to the Owner by the Bidder or Contractor, licensed under the Laws of Alabama

54. Work: The furnishing of all labor, materials, tools, equipment, and incidentals necessary or convenient to the Contractor's performance of all duties and obligations imposed by the Contract, Drawings, and Specifications

55. Written Notice: Any notice to any party of the Contract relative to any part of the Contract in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address, or delivered in person to said party or his authorized representative on the Work

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION (Not Used)

- END OF SECTION -

SECTION 01015
PROSECUTION AND PROGRESS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Subcontractors and Assignments

B. Notice to Proceed

C. Beginning and Completion of Work

D. Prosecution of the Work

E. Temporary Suspension of the Work

F. Weekend, Holiday, and Night Work

G. Contract Time

H. Failure to Complete Work on Time and Liquidated Damages

I. Annulment of Contract

J. Termination for National Emergencies

K. Notice and Service Thereof

1.02 RELATED WORK

A. Section 01010 – Summary of Work

B. Section 01025 – Measurement and Payment

C. Section 01310 – Progress Schedules

1.03 SUBCONTRACTS AND ASSIGNMENTS

A. The Contractor may utilize the services of specialty subcontractors on those parts of the Work which, under traditional contracting practices, are performed by specialty subcontractors.

B. The Contractor shall not award any Work to any subcontractor without prior written approval of the Owner; such approval shall not be given until the Contractor submits to the Owner a written statement, which shall contain such information as the Owner may require, concerning the proposed award to the subcontractor. All subcontractors shall carry insurance as specified in Section 00822 – Insurance Requirements.

C. The Owner shall not recognize any subcontractor on the Work. The Contractor shall at all times, when Work is in progress, be represented either in person by a qualified superintendent or by other designated qualified representative who is duly authorized to receive and execute orders of the Engineer. The Contractor shall be as fully responsible to the Owner for the acts and omissions of his subcontractors and of persons either directly or indirectly employed by them as he is for the acts and omissions of persons directly employed by him.

D. The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the Work to bind subcontractors to the Contractor by the terms of the General Conditions and other Contract Documents, insofar as applicable to the work of subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract Documents.

E. Nothing contained in this Contract shall create any contractual relation between any subcontractor and the Owner.

F. The Contractor shall not assign the whole or any part of this Contract or any monies due him or to become due under this Contract without written consent of the Owner. In case the Contractor assigns all or any part of any monies due him or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to the Contractor shall be subject to prior liens of all persons, firms, partnerships, and corporations for services rendered or materials supplied for the performance of the Work called for in this Contract.

1.04 NOTICE TO PROCEED

A. The Notice to Proceed shall state the date which the Owner directs the Contractor to begin the construction and from which date Contract Time shall be charged. The Contractor shall begin the Work to be performed under this Contract within 10 days of the date of the written Notice to Proceed, but in any event, the Contractor shall notify the Engineer at least 24 hours in advance of the time actual construction operations shall begin on the site.

1.05 BEGINNING AND COMPLETION OF WORK

A. It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning, rate of progress, and the time for completion of the Work to be performed under this Contract are ESSENTIAL CONDITIONS of this Contract, and it is further mutually understood and agreed that the Work embraced in this Contract shall be commenced within 10 days of the Notice to Proceed. Should the Contractor fail to initiate and prosecute the Work as previously stated herein, then the Owner may act to annul the Contract in accordance with this Section.

B. The Contractor agrees that said Work shall be prosecuted regularly, diligently, and uninterruptedly at such rate of progress to ensure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of the Work described in this Contract is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

C. It is further agreed that time is of the essence of each and every portion of this Contract and of the Specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever, and where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this Contract. Provided that the Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the Work is due:

    1. To any preference, priority, or allocation order duly issued by the State or Federal government;

    2. To unforeseeable cause beyond the control and without the fault or negligence of the Contractor including, but not limited to, Acts of God or of the public enemy, acts of another Contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather; and

    3. To any delays of subcontractors occasioned by any of the causes specified in Article 1.05, Paragraph C, Items 1 and 2.

D. Provided, further, that the Contractor shall, within ten (10) days from the beginning of such delay, notify the Owner in writing of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the Contractor within a reasonable time of its decision in the matter.

1.06 PROSECUTION OF THE WORK

A. The Contractor shall, at all times, employ sufficient labor and equipment for prosecuting the Work to full completion in the manner and time required by the Contract, Drawings, and Specifications.

B. All workers shall have sufficient skill and experience to properly perform the work assigned to them. Workers engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform the work satisfactorily.

C. Any person employed by the Contractor or by any subcontractor who, in the opinion of the Engineer, does not perform his Work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Engineer, be removed forthwith by the Contractor or subcontractor employing such person and shall not be employed again in any portion of the Work without the approval of the Engineer.

D. Should the Contractor fail to remove such person or persons or fail to furnish suitable and sufficient personnel for the proper prosecution of the Work, the Engineer may suspend the Work by written notice until compliance with such orders.

E. The Contractor shall comply with all federal, state, and local laws, regulations, and ordinances governing the employment of labor and the payment of wages thereto for Work performed under this Contract.

F. The Contractor shall furnish such equipment as is considered necessary for the prosecution of the Work in an acceptable manner and at a satisfactory rate of progress. All equipment which is proposed to be used on the Work shall be of sufficient size and in such mechanical condition as to meet requirements of the Work and to produce a satisfactory quality of Work. Equipment used on any portion of the Work shall be such that no injury to previously completed Work, adjacent property, or existing facilities shall result from its use. All equipment, tools, and machinery shall be subject to the approval of the Engineer.

G. When methods and equipment to be used by the Contractor in accomplishing the Work are not prescribed in the Contract, the Contractor is free to use any methods or equipment that he demonstrates, to the satisfaction of the Engineer, shall accomplish the Work in conformity with the requirements of the Contract, Drawings, and Specifications.

H. When the Contract specifies the use of certain methods and equipment, such methods and equipment shall be used unless others are authorized by the Engineer. If definite work methods are not prescribed in the Contract or if the Contractor desires to use a method or type of equipment other than specified in the Contract, he may request authority from the Engineer to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and the reasons for desiring to make the change. If approval is given, it shall be on the condition that the Contractor shall be fully responsible for producing Work in conformity with the Contract requirements and making demonstrations which are satisfactory to the Engineer. If, after trial use of the substituted methods or equipment, the Engineer determines that the Work produced does not meet Contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining Work with the specified methods

and equipment. The Contractor shall remove any deficient Work and replace it with Work of specified quality or take such other corrective action as the Engineer may direct. No change shall be made in basis of payment for the Contract items involved nor in Contract Time as a result of authorizing a change in methods or equipment under this Section.

1.07 TEMPORARY SUSPENSION OF THE WORK

A. The Engineer shall have the authority to suspend the Work wholly or in part for such period or periods of time as he may deem necessary due to unsuitable weather or such other reason as determined by the Owner to be in the best interest of the County. The Contractor shall proceed with the Work promptly when notified by the Engineer to resume operations.

B. The Contractor shall not suspend Work without written authority from the Engineer.

1.08 TIME OF WORK

A. The normal time of work for this Contract is limited to 40 hours per week, 8 hours per day, and shall generally be between the hours of 7:00 a.m. and 6:00 p.m., Monday through Friday.

B. Unless otherwise specifically permitted, all work that would be subject to damage shall be stopped during inclement, stormy, or freezing weather. Only such work as will not suffer injury to workmanship or materials will be permitted. Contractor shall carefully protect his work against damage or injury from the weather, and when work is permitted during freezing weather, he shall provide and maintain approved facilities for heating the materials and for protecting the finished work.

1.09 WEEKEND, HOLIDAY, AND NIGHT WORK

A. Work at night or on Saturdays, Sundays, trade-recognized legal holidays, or Owner's governmental-recognized legal holidays shall not be permitted except in case of emergency, and then only to such an extent as is absolutely necessary and with the written permission of the Owner.

B. Work at night or on weekends or holidays may be required when special connections to existing systems are to be made, when new facilities are to be placed in service, when existing facilities are to be taken out of service, when it is more advantageous to the utilities involved, or when an emergency arises in the Work schedule. In such cases, the permission of the Owner shall be received well in advance of the Work schedule, and arrangements shall be made for prosecution of the Work with all safety and minimum inconvenience to the public. All work necessary to be performed at night or on weekends or holidays shall be so performed without additional expense to the Owner.

1. Contractor's Notification of the Public for Night Work: For any work that the Owner specifically permits the Contractor to perform at night, the Contractor shall notify all property owners which could potentially be affected between 24 hours and 48 hours prior to beginning the work at night. This notification shall be accomplished by the Contractor distributing a door hanger, previously approved by the Owner, describing the work to be performed to adjacent residences and businesses that may be impacted. Door hangers shall be double-sided with the notification information in the English language on one side and in the Spanish language on the reverse side.

C. The Contractor may request permission from the Owner to work beyond the hours specified in Article 1.08, Paragraph A, or on weekends or holidays for his/her convenience provided that the extended work hours are approved at least 48 hours in advance in writing by the Owner and all costs incurred by the Owner and/or Engineer for additional engineering and inspection services performed by their inspectors and/or other personnel shall be borne by the Contractor in accordance with Section 01010 – Summary of Work and Section 00820 – Special Conditions.

1. The Owner shall have the right to deduct sufficient sums from monies due the Contractor to cover these additional engineering and inspection costs.

D. If it shall become imperative to perform work at night, the Owner and Engineer shall be informed a reasonable time in advance of the beginning of such work. Temporary lighting and all other necessary facilities for performing and inspecting the work shall be provided and maintained by the Contractor.

E. Maintenance work normally required for protection of persons, the Work, or property shall be permitted at anytime.

1.10 CONTRACT TIME

A. The number of calendar days allowed for completion of the Work shall be stated in the Proposal and Contract and shall be known as the Contract Time.

B. Should the Contract Time require extension for reasons beyond the Contractor's control, it shall be adjusted as follows:

1. Contract Time shall consist of the number of calendar days stated in the Contract counting from the effective date of the Notice to Proceed and including all Saturdays, Sundays, holidays, and non-work days. All calendar days elapsing between the effective dates of the Engineer's orders to suspend and resume all Work due to causes not the fault of the Contractor shall be excluded.

2. When the Contract Time is a specified completion date, it shall be the date by which all Contract Work shall be fully completed. If the Contractor finds it

impossible, for reasons beyond his control, to complete the Work within the Contract Time as specified or as extended in accordance with the provisions of this Section, he may, at any time prior to the expiration of the Contract Time as extended, make a written request to the Engineer for an extension of time, setting forth the reasons which he believes shall justify the granting of his request. The Contractor's plea that insufficient time was specified is not a valid reason for extension of time. If the Engineer finds that the Work was delayed because of conditions beyond the control of the Contractor, he may recommend that the Owner extend the time for completion in such amount as the conditions justify. The extended time for completion shall then be in full force and effect, the same as though it were the original time for completion.

3. The Director of Environmental Services may issue a time extension provided that the time extension does not change the Contract amount.

1.11 FAILURE TO COMPLETE WORK ON TIME AND LIQUIDATED DAMAGES

A. In case of delay in completion of the Work and in case the Owner does not terminate the Contractor's right to proceed, then the actual damages caused by the delay shall be impossible to accurately determine, in which event the Contractor shall pay to the Owner in lieu thereof, as fixed, agreed, and liquidated damages, an amount as stipulated in the Special Conditions for each calendar day of delay until the Work has been completed and accepted, and the Contractor and his sureties shall be liable to the Owner for the total amount thereof.

B. The Contractor is hereby advised that time is of the essence and that the Contract completion date shall be strictly observed. LIQUIDATED DAMAGES WILL BE ASSESSED IF THE CONTRACT TIME IS EXCEEDED. The Contractor may apply for an extension of time in accordance with provisions of the Contract. Such an extension of time must be approved prior to the Contract completion date to avoid imposition of liquidated damages. At the Owner's option, liquidated damages due may be taken from funds being retained.

1.12 ANNULMENT OF CONTRACT

A. The Contract may be annulled by the Owner for any of the following reasons:

1. Substantial evidence and belief that the progress being made by the Contractor is insufficient to complete the Work within the specified time

2. Deliberate failure on the part of the Contractor to proceed with the construction of the Work when so instructed by the Engineer or to observe any requirement of these Specifications

3. Failure on the part of the Contractor to promptly make good any defects in materials or construction that may be called to his attention by the Engineer

4. In case the Contractor becomes insolvent or is declared bankrupt, or allows any final legal judgment to stand against him unsatisfied, or shall make an assignment for the benefit of his creditors

B. Before the Contract is annulled, the Contractor and his surety shall first be notified in writing by the Owner of the conditions which make annulment of the Contract imminent. Fifteen (15) days after notice is given, if no effective effort has been made by the Contractor or his surety to correct the conditions for which complaint is made, the Owner may declare the Contract annulled, and shall notify the Contractor and his surety accordingly.

C. Upon receipt of notice from the Owner that the Contract has been annulled, the Contractor shall immediately discontinue all operations, safely secure all items of the Work, and remove his equipment. The Owner may then proceed with the construction in any lawful manner that it may elect until it is finally completed. When thus finally completed, the total cost of the Work (including all previous payments made to the Contractor) shall be computed and if this total cost is greater than the Contract price, the difference shall be paid to the Owner by the Contractor or his surety.

1.13 TERMINATION FOR NATIONAL EMERGENCIES

A. The Owner shall terminate the Contract or portion thereof by written notice when the Contractor is prevented from proceeding with the construction Contract as a direct result of an Executive Order of the President with respect to the prosecution of war or in the interest of national defense.

B. When the Contract, or any portion thereof, is terminated before completion of all items of Work in the Contract, payment shall be made for the actual number of units or items of Work completed at the Contract price or as mutually agreed for items of Work partially completed or not started. No claims for loss of anticipated profits shall be considered.

C. Reimbursement for organization of the Work, other overhead expenses (when not otherwise included in the Contract), and moving equipment and materials to and from the job shall be considered, the intent being that an equitable settlement shall be made with the Contractor.

D. Acceptable materials, obtained or ordered by the Contractor for the Work but not incorporated in the Work, shall, at the option of the Contractor, be purchased from the Contractor at actual cost as shown by receipted bills and actual cost records at such points of delivery as may be designated by the Engineer.

E. Termination of the Contract or a portion thereof shall neither relieve the Contractor of his responsibilities for the completed Work, nor shall it relieve his surety of its obligation for and concerning any just claim arising out of the Work performed.

1.14 NOTICE AND SERVICE THEREOF

A. All notices, demands, requests, instructions, approvals, and claims shall be in writing.

B. Any notice to or demand upon the Contractor shall be sufficiently given if delivered at the local office of the Contractor, or by personal service upon the representative of the Contractor in local charge of the Work, or by depositing in the United States mail in a sealed envelope with sufficient postage prepaid, addressed to such Contractor at the address stated by the Contractor in the Proposal, or at the local address used by the Contractor in the Proposal, or at the local address used by the Contractor during the process of the Work, or at such other address as the Contractor may from time to time designate to the Owner in writing. Any notice to or demand upon the Contractor shall also be sufficiently given if transmitted to the Contractor through electronic facsimile.

C. Any notice to or demand upon the Owner shall be sufficiently given if delivered to the Owner or deposited in the United States mail in a sealed envelope with sufficient postage prepaid, or delivered with charges prepaid to said Owner or to authorized representatives of the Owner, or to such address as the Owner may subsequently specify in writing to the Contractor for such purposes.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

- END OF SECTION –

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SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The following subsections describe the measurement and payment for Work to be done under the items listed in the Bid Proposal Form of the Bid Proposal. Each lump sum price stated in the Bid Proposal Form shall constitute full compensation for each item of Work completed. The Contractor shall provide all labor, materials, tools, equipment, and services required to complete the Work as specified and shown in the Contract Documents.

B. Payment for the various items in the Bid Proposal Form, as further specified herein, shall include all compensation to be received by the Contractor for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, supervision, operations, taxes, materials, commissions, transportation and handling, bonds, permit fees, insurance, overhead and profit, and incidentals appurtenant to the items of Work being described, as necessary to fully complete the various items of the Work all in accordance with the requirements of the Contract Documents, including all appurtenances thereto, and including all costs of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). Such compensation shall also include payment for any loss or damages arising directly or indirectly from the Work.

C. The Contractor's attention is called to the fact that the quotations for the various items of Work are intended to establish a total price for completing the Work in its entirety. Should the Contractor feel that the cost for any item of Work has not been established by the Bid Items of the Bid Proposal Form or this Section, he shall include the cost for that Work in some other applicable Bid Item, so that his proposal for the Project does reflect his total price for completing the Work in its entirety.

1.02 UNIT QUANTITIES SPECIFIED

A. Quantities and measurements indicated in the Bid Proposal Form are estimated and are only to be used as a basis for estimating the probable cause of the Work and for the purpose of comparing the Bids submitted for the Work. Actual quantities and measurements supplied or placed in the Work and verified by the Engineer may differ from the estimated quantities and shall be the basis for payment.

B. If the actual Work requires more or fewer quantities than those approximate quantities indicated, the Contractor shall provide the actual quantities required at the unit prices contracted. Contractor agrees that he shall make no claim for damages, anticipated profits, or otherwise on account of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts therefore.

C. The Owner reserves the right to alter the quantities of Work to be performed or to extend or shorten the improvement at any time, as may be found to be necessary or desirable. Such increases, decreases, and/or other alterations shall not invalidate the Contract nor release the Surety and the Contractor. The Contractor agrees to accept the Work as altered, the same as if it had been part of the original Contract. No claims shall be made by the Contractor for any loss of anticipated profits because of any such alteration, nor shall such alteration be considered as waiving or invalidating any conditions or provisions of the Contract.

1.03 ITEMS OF THE BID PROPOSAL

A. The specific areas where the work described herein and in the Bid Proposal Form of the Bid Proposal shall be performed by the Contractor is detailed on Drawings 10-C100 through 30-E603.

B. Bid Item No. 1 – Mobilization and Demobilization: Payment for Bid Item No. 1 will be made according to the lump sum price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to provide the items specified in Section 01505 – Mobilization and Demobilization. The work under Bid Item No. 1 shall also include, but not be limited to, any permits, licenses, fees, insurance, and bonds, assembling all equipment, materials, tools, etc., and transporting them to and from the work site. The amount bid for Bid Item No. 1 – Mobilization and Demobilization shall not exceed 5 percent of the Grand Total of Bid. Payment for standard mobilization and demobilization shall only be made once, in accordance with the schedule in Section 01505 – Mobilization and Demobilization, regardless of the number of times (excluding emergency mobilization and demobilization) that the Contractor actually mobilizes and demobilizes to the partial sanitary sewer basins that comprise the location of the Work.

C. Bid Item No. 2 – Allowance for Natural Gas Service Improvements: Payment for Bid Item No. 2 will be paid for actual costs incurred to furnish the Owner natural service upgrades as required for the pump station improvements. The aid to construction will be paid in the amount necessary for the natural gas service provider (Spire) to install or upgrade utility service (if necessary) at the Jefferson Metropolitan and McAdory Pump Stations. The Contractor shall coordinate with the utility and the Owner prior to any shutdowns. Scope of services includes, but is not limited to, necessary upgrades to natural gas services lines, natural gas meters, and any other appurtenances necessary to service the pump station. The contractor shall furnish a final invoice from the natural gas service provider for payment to perform the work. Payment shall be in the same amount as the final invoice.

D. Bid Item No. 3 – Allowance for Refurbishment of Pumping Equipment at Coleman Lakes PS: Payment for Bid Item No. 3 will be paid for repairs, equipment replacement, and equipment refurbishment for two (2) Fairbanks-Morse flooded suction pumps and motors. The aid to construction will be paid in the amount necessary for a manufacturer's representative to provide the repairs and equipment replacement to the existing pumps at the Coleman Lakes Pump Station. Scope of services includes, but is not limited to, replacement with 10-inch impellers, replacement of seals, gaskets, bearings, and motor servicing. The contractor shall

furnish a final invoice from the manufacturer's representative for payment to perform the work. Payment shall be in the same amount as the final invoice.

E. Bid Item No. 4 – Jefferson Metropolitan Pump Station Improvements: Payment for Bid Item No. 4 will be made according to the unit prices in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform Jefferson Metropolitan Pump Station Improvements as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 4 shall include, but not be limited to, providing all labor, materials, equipment, and tools required for pump station improvements which may include demolition of existing pump station and equipment removal, demolition of asphalt paving, abandonment of existing force main, construction of concrete wet well and valve vault, installation of gravity sewer piping, valves, and manholes, installation of wastewater submersible pumps and appurtenances, installation of electromagnetic flow meter and vault, installation of discharge piping, valves, and fittings through the connection to the existing force main, concrete site paving, asphalt paving, and site fencing. Electrical components included with this pay item include all necessary electrical improvements to the station including conduit, wiring, duct banks, grounding, and any other labor, materials, or equipment associated with the electrical components to complete the work. All bypass pumping required to maintain wastewater flow shall be included in this pay item. All work included with this pay item include all necessary labor, materials, and equipment required in the Contract Documents to demolish the existing station and force main, remove equipment, prepare, and construct the new pump station and site improvements, and connect to the force main.

F. Bid Item No. 5 – Coleman Lakes Pump Station Improvements: Payment for Bid Item No. 5 will be made according to the unit prices in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform Coleman Lakes Pump Station Improvements as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 5 shall include, but not be limited to, providing all labor, materials, equipment, and tools required for pump station improvements which may include removal of existing wet well lining, coating of wet well interior surfaces, removal and replacement of existing hydraulic grinder and control panel, and removal and replacement of one (1) air release valve along the existing force main route. All bypass pumping required to maintain wastewater flow shall be included in this pay item. All work included with this pay item include all necessary labor, materials, and equipment required in the Contract Documents to remove equipment, prepare, rehabilitate, and replace equipment.

G. Bid Item No. 6 – McAdory Pump Station Improvements: Payment for Bid Item No. 6 will be made according to the unit prices in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform McAdory Pump Station Improvements as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 6 shall include, but not be limited to, providing all labor, materials, equipment, and tools required for pump station improvements which may include demolition of existing pump station and equipment removal, construction of new pump station CMU block and brick veneer building, installation of new wet well top slab, cleaning and coating of wet well interior, installation of prepackaged suction-lift pump station and appurtenances, installation of discharge piping and fittings through the connection to the existing force main, installation

of odor control system including equipment pad and suction piping, concrete site and access drive paving, and site fencing. Electrical components included with this pay item include all necessary electrical improvements to the station including conduit, wiring, duct banks, grounding, and any other labor, materials, or equipment associated with the electrical components to complete the work. All bypass pumping required to maintain wastewater flow shall be included in this pay item. All work included with this pay item include all necessary labor, materials, and equipment required in the Contract Documents to demolish the existing station, remove equipment, prepare, and construct the new pump station, perform site improvements, and connect to the existing force main.

H. Bid Item No. 7 – 6-Inch Diameter HDPE Force Main and Required Appurtenances (Bedding Included): Payment for Bid Item No. 7 will be made according to the unit price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform installation of 6-Inch Diameter HDPE Force Main as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 7 shall include, but not be limited to, providing all labor, materials, equipment, and tools required for excavation, dewatering, pipe bedding, backfill and compaction, pipe furnishing, pipe laying, utility crossings, vegetation clearing and removal, removing and replacing driveway culverts, drainage structures, and mailboxes, and all other labor, materials and equipment necessary to complete the work required in the Contract Documents.

I. Bid Item No. 8 – 6- Inch Diameter D.I.P. 45 Degree Bend, Thrust Block, and Required Appurtenances: Payment for Bid Item No. 8 will be made according to the unit price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform installation of 6-Inch Diameter 45 Degree Bends as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 8 shall include, but not be limited to, providing all labor, materials, equipment, and tools required for excavation, dewatering, bedding, backfill and compaction, fitting furnishing with ceramic epoxy liner, fitting installation, thrust block, and all other labor, materials and equipment necessary to complete the work required in the Contract Documents.

J. Bid Item No. 9 – 6- Inch Diameter D.I.P. 22.5 Degree Bend, Thrust Block, and Required Appurtenances: Payment for Bid Item No. 9 will be made according to the unit price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform installation of 6-Inch Diameter 22.5 Degree Bends as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 9 shall include, but not be limited to, providing all labor, materials, equipment, and tools required for excavation, dewatering, bedding, backfill and compaction, fitting furnishing with ceramic epoxy liner, fitting installation, thrust block, and all other labor, materials and equipment necessary to complete the work required in the Contract Documents.

K. Bid Item No. 10 – 6-Inch D.I. Gate Valve and Required Appurtenances: Payment for Bid Item No. 10 will be made according to the unit price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform installation of 6-Inch D.I. Gate Valve as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 10 shall include, but not be limited to, providing all labor, materials,

equipment, and tools required for excavation, dewatering, bedding, backfill and compaction, valve furnishing and installation, and all other labor, materials and equipment necessary to complete the work required in the Contract Documents.

L. Bid Item No. 11 – Connection to Existing 6-Inch Force Main: Payment for Bid Item No. 11 will be made according to the unit price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform connection to the existing 6-inch force main as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 11 shall include, but not be limited to, providing all labor, materials, equipment, and tools required for excavation, dewatering, bedding, backfill and compaction, furnishing materials and installation, and all other labor, materials and equipment necessary to complete the work required in the Contract Documents.

M. Bid Item No. 12 – Core Drill and Connection to Existing Sanitary Sewer Manhole: Payment for Bid Item No. 12 will be made according to the unit price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform core drill and connection to the existing sanitary sewer manhole as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 12 shall include, but not be limited to, providing all labor, materials, equipment, and tools required for core drilling, installing drop pipe connection and appurtenances, providing link seal, required grout, and cleaning and coating of manhole interior, and all other labor, materials and equipment necessary to complete the work required in the Contract Documents.

N. Bid Item No. 13 – 2-Inch Air Relief / Anti-Vacuum Valve and Vault and Required Appurtenances: Payment for Bid Item No. 13 will be made according to the unit price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform installation of 2-Inch Air Relief / Anti-Vacuum Valve as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 13 shall include, but not be limited to, providing all labor, materials, equipment, and tools required for excavation, dewatering, bedding, backfill and compaction, valve furnishing and installation, vault furnishing and installation, and all other labor, materials and equipment necessary to complete the work required in the Contract Documents.

O. Bid Item No. 14 – Lump Sum Roadway Bore – 75 LF of 12-Inch Steel Casing (0.25" Thick) W/ 75 LF 6-Inch HDPE. Carrier Pipe: Payment for Bid Item No. 14 will be made according to the unit price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform installation of Lump Sum Roadway Bore as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 14 shall include, but not be limited to, providing all labor, materials, equipment, and tools required for excavation, dewatering, 12-inch steel casing pipe, casing spacers, pipe fittings, adapters, 6-inch HDPE carrier pipe, any and all incidentals necessary to complete the crossing satisfactorily and acceptable to the agencies having jurisdiction over the crossing, the Engineer, and the Owner, and all other labor, materials and equipment necessary to complete the work required in the Contract Documents. If the total length of the bore is extended or reduced, price and payment shall be paid as a ratio of the Contract Lump Sum Price.

P. Bid Item No. 15 – Portland Cement Concrete Paving: Payment for Bid Item No. 15 will be made according to the unit price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to provide Portland Cement Concrete Paving as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 15 shall include, but not be limited to, providing all labor, materials, equipment, and tools required for grading, paving and drainage, sub-base, base, concrete paving and any other labor, materials, and equipment necessary to complete the work required in the Contract Documents. This Bid Item will not be used to pay for Portland Cement Concrete Paving at any pump station site. Payment for paving at pump stations will be paid for under the respective lump sum bid item for pump station improvements.

Q. Bid Item No. 16 – Asphalt Concrete Paving: Payment for Bid Item No. 16 will be made according to the unit price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to provide Asphalt Concrete Paving as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 16 shall include, but not be limited to, providing all labor, materials, equipment, and tools required for grading, paving and drainage, sub-base, base, asphalt bituminous paving and any other labor, materials, and equipment necessary to complete the work required in the Contract Documents. This Bid Item will not be used to pay for Asphalt Concrete Paving at any pump station site. Payment for paving at pump stations will be paid for under the respective lump sum bid item for pump station improvements.

R. Bid Item No. 17 – Temporary and Permanent Grassing: Payment for Bid Item No. 17 will be made according to the unit price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to provide Temporary and Permanent Grassing as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 17 shall include, but not be limited to, providing all labor, materials, equipment, and tools required for site restoration, final grading, topsoil preparation, preparation for seeding, temporary seeding, temporary mulching, permanent seeding, permanent mulching and any other labor, materials, and equipment necessary to complete the work required in the Contract Documents. This Bid Item will not be used to pay for Temporary or Permanent Grassing at any pump station site. Payment for grassing at pump stations will be paid for under the respective lump sum bid item for pump station improvements.

S. Bid Item No. 18 – Silt Fencing: Payment for Bid Item No. 18 will be made according to the unit price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform Silt Fencing as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 18 shall include, but not be limited to, providing all labor, materials, equipment, and tools required, for installation, repair, maintenance, removal and replacement of silt fence, any and all incidentals associated with this work, and any other labor, materials, and equipment necessary to complete the work required in the Contract Documents. This Bid Item will not be used to pay for Silt Fencing at any pump station site. Payment for silt fence at pump stations will be paid for under the respective lump sum bid item for pump station improvements.

T. Bid Item No. 19 – Additional Erosion Control Measures: Payment for Bid Item No. 19 will be made according to the unit price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform Additional Erosion Control Measures as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 19 shall include, but not be limited to, providing all labor, materials, equipment, and tools required (other than silt fencing) for installation, repair, maintenance, and removal of required additional erosion control measures necessary to complete the work required in the Contract Documents. This Bid Item will not be used to pay for Additional Erosion Control Measures at any pump station site. Payment for additional erosion control at pump stations will be paid for under the respective lump sum bid item for pump station improvements.

U. Bid Item No. 20 – Traffic Control: Payment for Bid Item No. 20 will be made according to the unit price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform Traffic Control as specified throughout the Specifications and as shown on the Drawings. The work under Bid Item No. 20 shall include, but not be limited to, providing all labor, materials, equipment, and tools required to perform traffic control using barricades, signs, illumination, watchmen, flagmen, etc. along existing roadways located within the project site as necessary to complete the work required in the Contract Documents.

V. Bid Item No. 21 – Allowance for Owner-Directed Additional Electrical Improvements: Payment for Bid Item No. 21 will be limited to the fixed bid price shown in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform Owner-Directed Additional Electrical Improvements, in the sole judgment of the Owner, could not have been determined from the Bidding Documents. Bid Item No. 21 shall be paid as necessary to complete additional improvements due to unforeseen site conditions incurred during construction that are determined to be above and beyond improvements included in other pay items. The amount necessary to compensate additional improvements will be paid in the amount necessary for improvements.

W. Bid Item No. 22 – Allowance for Owner-Directed Additional Structural Improvements: Payment for Bid Item No. 22 will be limited to the fixed bid price shown in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform Owner-Directed Additional Structural Improvements, in the sole judgment of the Owner, could not have been determined from the Bidding Documents. Bid Item No. 22 shall be paid as necessary to complete additional improvements due to unforeseen site conditions incurred during construction that are determined to be above and beyond improvements included in other pay items. The amount necessary to compensate additional improvements will be paid in the amount necessary for improvements.

X. Bid Item No. 23 – Allowance for Owner-Directed Additional Civil Improvements: Payment for Bid Item No. 23 will be limited to the fixed bid price shown in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform Owner-Directed Additional Civil Improvements, in the sole judgment of the Owner, could not have been determined from the Bidding Documents. Bid Item No. 23 shall be paid as necessary to complete additional improvements due to unforeseen site conditions incurred during construction that

are determined to be above and beyond improvements included in other pay items. The amount necessary to compensate additional improvements will be paid in the amount necessary for improvements.

Y. Bid Item No. 24 – Allowance for Owner-Directed Additional Mechanical Improvements: Payment for Bid Item No. 24 will be limited to the fixed bid price shown in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to perform Owner-Directed Additional Mechanical Improvements, in the sole judgment of the Owner, could not have been determined from the Bidding Documents. Bid Item No. 24 shall be paid as necessary to complete additional improvements due to unforeseen site conditions incurred during construction that are determined to be above and beyond improvements included in other pay items. The amount necessary to compensate additional improvements will be paid in the amount necessary for improvements.

Z. Bid Item No. 25 – Allowance for Materials Testing: Payment for Bid Item No. 25 will be paid for actual costs incurred to hire a JCESD approved materials testing company to perform material testing specified throughout these Specifications and as shown on the Drawings. The contractor shall furnish a final invoice from the materials testing company for payment to perform the work. Payment shall be in the same amount as the final invoice.

AA. Bid Item No. 26 – Allowance for Start-up, Testing, and Use of New Facilities: Payment for Bid Item No. 26 will be made according to the unit price in the Bid Proposal Form of the Bid Proposal, which shall constitute full payment to provide Start-up, Testing, and Use of New Facilities as specified throughout these Specifications and as shown on the Drawings. The work under Bid Item No. 26 shall include, but not be limited to, furnishing the Owner with an operable and completed series of wastewater pump stations, force mains, gravity sewer manholes, and gravity sanitary sewer piping, which have successfully passed all tests and have been approved by all authorities for use by the Owner as intended and are put into service. The price in this item represents a unit price that is established by the Owner and used by all Contractors bidding the project. The amount of money written in this item will be paid to the Contractor when the entire project is approved for service by the Engineer and all authorities and/or all project components are in service and all landscaping, site work, drainage work, repairs, and final cleanup of the project site have been accomplished. Since all components of the proposed improvements and cleanup are an integral part of the entire project needed by the Owner, partial payment will not be allowed for this bid item.

1.04 AUTHORITY

A. Measurement methods delineated in the individual Specification Sections are intended to complement the criteria of this Section. In the event of conflict, the requirements of the individual Specification Section shall govern.

1.05 UNIT QUANTITIES SPECIFIED

A. Quantities and measurements indicated in the Bid Proposal Form are estimated and are only

to be used as a basis for estimating the probable cause of the Work and for the purpose of comparing the Bids submitted for the Work. Actual quantities and measurements supplied or placed in the Work and verified by the Engineer may differ from the estimated quantities and shall be the basis for payment.

B. If the actual Work requires more or fewer quantities than those approximate quantities indicated, the Contractor shall provide the actual quantities required at the unit prices contracted. Contractor agrees that he shall make no claim for damages, anticipated profits, or otherwise on account of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts therefore.

C. The Owner reserves the right to alter the quantities of Work to be performed or to extend or shorten the improvement at any time, as may be found to be necessary or desirable. Such increases, decreases, and/or other alterations shall not invalidate the Contract nor release the Surety and the Contractor. The Contractor agrees to accept the Work as altered, the same as if it had been part of the original Contract. No claims shall be made by the Contractor for any loss of anticipated profits because of any such alteration, nor shall such alteration be considered as waiving or invalidating any conditions or provisions of the Contract.

1.06 MEASUREMENT OF QUANTITIES

A. The determination of quantities of Work acceptably completed under the terms of the Contract will be made by the Engineer, based on measurements taken by him or his assistants. These measurements will be taken according to the United States standard measurements and in the manner as specified in these Specifications.

B. Measurement Devices

1. Scales shall be inspected, tested, and certified by the applicable Weights and Measures Department within the past year and shall be of sufficient size and capacity to accommodate the conveying vehicle.

2. Metering devices shall be inspected, tested, and certified by the applicable department within the past year.

C. Volume shall be determined by cubic dimension by multiplying mean length by mean width by mean height or thickness.

D. Area shall be determined by square dimension by multiplying mean length by mean width or height.

E. Linear measurement shall be measured by linear dimension along the item centerline or mean chord.

F. Stipulated price measurement shall include items measured by number, weight, volume, area, length, or combination thereof, as appropriate.

1.07 SCOPE OF PAYMENT

A. The Contractor shall receive and accept compensation, as herein provided, as full payment for furnishing all labor, materials, tools, equipment, and incidentals; for performing all Work contemplated and embraced under the Contract; for all loss or damage arising out of the nature of the Work or from the action of the elements; for any unforeseen defects or obstructions which may arise during the prosecution of the Work and before its Final Acceptance by the Owner; for all risks connected with the prosecution of the Work; for all expenses incurred by or in consequence of suspension or discontinuance of such prosecution of the Work herein specified; for any infringement of patents, trademarks, or copyrights; and for completing the Work in an acceptable manner according to the Drawings and Specifications.

B. Upon payment therefore, materials or work in place shall become the property of the Owner; however, the payment of any partial or periodical estimates prior to Final Acceptance of the Work by the Owner shall in no way constitute an acknowledgment of the acceptance of the Work, in part or in total, nor in any way prejudice or affect the obligation of the Contractor to repair, correct, renew, or replace, at his expense, any defects or imperfections in the construction or in strength or quality of the materials used in the construction of the Work under the Contract.

C. Final payment for work governed by unit prices shall be made on the basis of the actual measurements and quantities accepted by the Engineer multiplied by the unit price for the work which is incorporated in or made necessary by the Contract.

D. Final payment for work governed by lump sum shall be made after the Engineer accepts the lump sum work.

E. Payment for this Project will be by monthly payments to be paid upon the Engineer's approval. A pay request will be submitted at the end of each month to the Engineer.

1.08 ALTERATION OF DRAWINGS AND SPECIFICATIONS

A. Owner reserves the right, at any time, to make such changes to the Drawings and the character of the Work as may be necessary or desirable to ensure completion in the most satisfactory manner, provided such changes do not materially alter the original Drawings and Specifications or change the general nature of the Work as a whole. Such changes shall not be considered as waiving or invalidating any conditions or provision of the Contract.

1.09 COMPENSATION FOR ALTERED QUANTITIES

A. When the accepted quantities of work vary from the quantities in the Proposal, the Contractor shall accept as payment in full, so far as Contract Items are concerned, payment at the original Contract price for the quantities of work actually completed and accepted. No allowance shall be made for increased expense, loss of expected reimbursement, or loss of

anticipated profits suffered or claimed by the Contractor which results directly from such alterations or indirectly from his unbalanced allocation of overhead and profit among the Contract Items or from any other cause.

1.10 PAYMENT FOR OMITTED ITEMS

A. The Owner may, in the Owner's best interest, omit from the Work any Contract Item. Such omission of Contract Items shall not invalidate any other Contract provision or requirement. No claim for lost profit on deleted work will be allowed.

B. The Engineer shall have the right to omit from the Work any non-performed Contract Item which, in his opinion, is in the best interest of the Owner.

C. Should a Contract Item be omitted or otherwise ordered not to be performed, the Contractor shall be paid for all work performed toward completion of such item prior to the date of the order to omit such item. Payment for work performed shall be as specified in this Section.

D. Should the Engineer omit or order nonperformance of a Contract Item or portion of such item from the Work, the Contractor shall accept payment in full at the Contract unit price for any work actually completed and acceptable prior to the Engineer's order to omit or non-perform such Contract Item.

E. Acceptable materials ordered by the Contractor or delivered on the Work prior to the date of the Engineer's order will be paid for at the actual cost to the Contractor and shall thereupon become the property of the Owner.

F. In addition to the reimbursement provided in this section, the Contractor shall be reimbursed for all actual costs incurred for the purpose of performing the omitted Contract Item prior to the date of the Engineer's order. Such additional costs incurred by the Contractor must be directly related to the deleted Contract Item and shall be supported by certified statements by the Contractor as to the nature and amount of such costs.

1.11 CLAIMS FOR EXTRA WORK

A. If the Contractor claims that any instructions by the Engineer or otherwise involve extra cost on his part, he shall give the Engineer written notice of said claim within ten (10) days after the receipt of such instructions, and in any event before proceeding to execute that portion of Work, stating clearly and in detail the basis of his claim or claims. No such claim shall be valid unless so made.

B. Claims for additional compensation for extra work due to alleged errors in spot elevations, contour lines, or benchmarks will not be recognized unless accompanied by certified survey data, made prior to the time the original ground was disturbed, clearly showing that errors exist which resulted, or would result, in handling more material or performing more Work than would reasonably be estimated from the Drawings and topographical maps issued.

C. Any discrepancies which may be discovered between actual conditions and those represented by the topographical maps and Drawings shall be reported to the Engineer at once, and Work shall not proceed, except at the Contractor's risk, until written instructions have been received by the Contractor from the Engineer.

D. If, on the basis of the available evidence, the Engineer determines that an adjustment of the Contract price or time is justifiable, the procedure shall then be as provided in Section 01028 – Change Order Procedures.

E. By execution of this Contract, the Contractor warrants that he has visited the site of the proposed Work, has fully acquainted himself with the existing conditions relating to construction and labor, and fully understands the facilities, difficulties, and restrictions attending the execution of the Work under this Contract. The Contractor further warrants that he has thoroughly examined and is familiar with the Drawings, Specifications, and all other documents comprising the Contract. The Contractor further warrants that by execution of this Contract, his failure when he was bidding on this Contract to receive or examine any form or document, or to visit the site and acquaint himself with existing conditions, in no way relieves him from any obligation under the Contract, and the Contractor agrees that the Owner shall be justified in rejecting any claim based on facts regarding which he should have been on notice as a result thereof.

1.12 PAYMENT FOR EXTRA WORK

A. Should acceptable completion of the Contract require the performance of an item of Work for which no basis of payment has been provided in the original Contract or previously issued Change Orders, the same shall be called "Extra Work". Extra Work that is within the general scope of the Contract shall be covered by written Change Order. Change Orders for such Extra Work shall contain unit prices, lump sum, or time and material prices agreed upon through negotiation for performing the Work covered by the Change Order, in accordance with the requirements specified in the Change Order, and shall contain any adjustment to the Contract time that, in the Owner's opinion, is necessary for completion of such Extra Work. The Contractor shall not perform any Work on a proposed Change Order until he receives written authorization from the Engineer.

B. The Owner may, at its discretion, elect to perform the Extra Work with its own forces or hire any such person, firm, partnership, or corporation to perform the Extra Work. Performance of the Extra Work by either of these methods shall not waive or invalidate any conditions or provisions of the Contract.

C. Any claim for payment of Extra Work that is not covered by a Change Order shall be rejected by the Owner.

D. Extra Work, approved by the Engineer and performed in accordance with these Specifications, shall be paid for at the Contract unit prices or agreed prices specified in the Change Order authorizing such Extra Work.

E. When determined by the Engineer to be in the Owner's best interest, the Contractor may be ordered to proceed with Extra Work on the following basis:

1. Labor: For all labor (skilled and unskilled) and foremen in direct charge of a specific Extra Work item, the Contractor shall be reimbursed at the same rate of wage (or scale) being paid to such skilled and unskilled labor and foremen under the original Contract. Such wage or scale shall be agreed upon prior to beginning the Extra Work. The Contractor shall be reimbursed for the actual costs paid to, or on behalf of, workers by reason of subsistence and travel allowances, health and welfare benefits, pension fund benefits, or other benefits, when such amounts are required by collective bargaining agreement or other employment contract generally applicable to the classes of labor employed on the Work.

2. Insurance and Taxes: For property damage, liability, and Workmen's Compensation Insurance premiums, unemployment insurance contributions, and social security taxes on the Extra Work, the Contractor shall be reimbursed at the actual cost. The Contractor shall furnish satisfactory evidence of the rate or rates paid for such insurance and taxes.

3. Materials: For materials installed and accepted by the Engineer, the Contractor shall receive the actual cost of such materials, including transportation charges paid by him (exclusive of machinery rentals as hereinafter set forth).

4. Equipment: For any machinery or special equipment (other than small tools), including the costs of fuel, lubricants, and transportation, the use of which has been authorized by the Engineer, the Contractor shall be reimbursed at the rental rates agreed upon in writing before such work is begun for the actual time that such equipment is committed to the Work and necessary for the actual prosecution of the Work.

5. Miscellaneous: No additional reimbursement will be made for general superintendence, the use of small tools, or other costs for which no specific allowance is herein provided.

6. Overhead and Profit: Fifteen (15) percent shall be added to the actual reimbursable cost, as previously enumerated, for overhead and profit. The Contractor shall be entitled to eight (8) percent of subcontractors' costs to defer cost of insurance, supervision, and management. The subcontractors shall be entitled to actual cost of performing the Extra Work plus fifteen (15) percent of actual cost to cover supervision, overhead, bond, and profit. The Contractor shall submit to the Owner itemized cost sheets showing actual cost of performance of the Extra Work. Actual costs are defined as follows:

   a. Labor costs, including time of foremen, while directly engaged on the Extra Work

b. Labor Insurance and Workmen's Benefits

c. Social Security and unemployment contributions

d. Ownership or rental costs of construction equipment used in the actual prosecution of the Extra Work. Such costs shall not exceed those listed in the latest publication of the Rental Rate Blue Book for Construction Equipment published by PRIMEDIA Information Incorporated or rental rates prevailing in the area of the Work. Charges for equipment already allocated to the Project shall be based upon standard or prevailing monthly rental rates. Rental rates or use rates shall not be charged for equipment having a value of $200.00 or less since equipment and tools of the lesser value stated are considered to be "small tools" and, as such, are considered to be part of overhead.

e. Costs of materials and/or equipment entering permanently into the Work

f. Costs of power and consumable supplies for the operation of power equipment where such costs are not included in rental rates or use charges

7. Comparison of Records: The Contractor and the Engineer shall compare records of the cost of Extra Work at the end of each day. Agreement shall be indicated by signature of the Contractor and Engineer or their daily authorized representatives.

8. Statement: No payment will be made for Extra Work performed until the Contractor has furnished the Engineer with duplicate itemized statements of the cost of such work detailed as follows:

a. Name, classification, date, daily hours, total hours, rate, and extension for each laborer and foreman

b. Designation, dates, daily hours, total hours, rental rate, and extension for each unit of machinery and equipment

c. Quantities of materials, prices, and extensions

d. Transportation of materials

e. Cost of property damage, liability and Workmen's Compensation Insurance premiums, unemployment insurance contributions, and Social Security tax

f. Statements shall be accompanied and supported by receipted invoices for all materials used and transportation charges. However, if materials used on the Extra Work are not specifically purchased for such Work but are taken from the Contractor's stock, then, in lieu of the invoices, the Contractor shall furnish an affidavit certifying that such materials were taken from his stock, that the

quantity claimed was actually used, and that the price and transportation claimed represent the actual cost to the Contractor.

g. Payment for overhead and profit based on the percentages previously specified shall constitute full compensation for all items of expense incurred but not specifically detailed for the Extra Work. The total payment made as previously described shall constitute full compensation for such work.

1.13 PARTIAL PAYMENTS (ESTIMATES)

A. At the end of each calendar month during the life of the Contract, the Engineer and Contractor shall agree on an estimate of the quantities of Work completed and of the total amount due therefor. Upon acceptance of the estimate by the Contractor and the Engineer, a partial payment will be made to the Contractor equivalent in amount to the value of all work done to the end of the preceding month, less the percent of such amount to be retained as specified in this Section, less previous payment.

1.14 RETAINAGE

A. In making partial payments, the Owner shall retain five (5) percent of the estimated value of work done until fifty (50) percent completion of the Work has been accomplished. No additional retainage will be withheld after fifty (50) percent completion.

B. The Contractor may request that the Owner accept a Certificate of Deposit (CD) issued in the joint names of the Owner and the Contractor in place of retainage. The CD shall be conditionally assigned by the Contractor to the Owner. CD's shall be issued in increments of $10,000.00 minimum by a federally insured Bank or Savings and Loan Association in Jefferson County. The issuer of certificates shall not cash the CD without written approval of the Owner. Interest will be retained with the CD and all subsequent renewals. The Contractor shall be required to request the acceptance of the CD in place of retainage and, upon approval, shall receive specific instructions from the Owner regarding procedures to be followed.

C. The Contractor agrees that he will indemnify and save the Owner harmless from all claims arising out of the lawful demands of subcontractors, laborers, workmen, mechanics, and suppliers of machinery, parts, equipment, power tools, fuel, materials, and other construction items, incurred in the performance of Work under this Contract. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the nature herein previously described have been paid, discharged, or waived. If the Contractor should fail to do so, then the Owner may, after having served written notice on the Contractor, either directly pay those unpaid bills for which the Owner has received written notice or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is presented that all such liabilities have been fully discharged, whereupon payment to the Contractor shall be resumed in accordance with the terms of this Contract, but in no event shall the provisions of this article be construed to impress upon the Owner any obligations to either the Contractor or his

Surety. In paying any unpaid bills of the Contractor, the Owner shall be deemed to be the temporary agent of the Contractor for this specified purpose; any payment so made by the Owner shall be considered as a payment made under the Contract by the Owner to the Contractor, and the Owner shall not be liable to the Contractor for any such payments made in good faith.

1.15 PAYMENT FOR MATERIALS STORED

A. Unless stated otherwise in the Special Conditions, partial payments may be made to the extent of the delivered cost of materials to be incorporated into the Work, provided that such materials meet the requirements of the Contract, Drawings, and Specifications, are listed in the Bid Proposal Form, are delivered to acceptable locations of the Work site, and are properly stored in accordance with the manufacturer's recommendations and the requirements of Section 01550 – Site Access and Storage. Such delivered costs of stored or stockpiled materials may be included in the next partial payment after the following conditions are met:

1. The material has been stored or stockpiled in a manner acceptable to the Engineer at or on an approved site.

2. The Contractor has furnished the Engineer with acceptable evidence of the quantity and quality of such stored or stockpiled materials.

3. The Contractor has furnished the Owner evidence that the material so stored or stockpiled is insured against loss by damage to or disappearance of such materials at any time prior to use in the Work.

4. The Contractor has submitted documentation to the Engineer indicating that for any powered equipment being stored, the equipment item's electric motor shaft has been periodically rotated in accordance with the manufacturer's requirements, periodic lubrication of motor bearings and shaft, if required, has been performed in accordance with the manufacturer's requirements, and all storage has been performed in compliance with the equipment warranty. Documentation shall include a rotation log which states the date of the last motor shaft rotation for each piece of equipment being stored at that time.

B. Unless otherwise agreed upon with the Owner, by the second estimate following the estimate for which the Contractor has been paid for materials stored, the Contractor must show evidence, in the form of a certified paid invoice, that he has paid the supplier for the materials; otherwise the amount of material costs previously paid shall be deducted from the current estimate.

C. It is understood and agreed that the Owner's payment for such stored or stockpiled materials shall in no way relieve the Contractor of his responsibility for furnishing and placing such materials in accordance with the requirements of the Contract, Drawings, and Specifications.

D. In no case will the amount of partial payments for materials on hand exceed 80 percent of the Contract price for such materials or the Contract price for the Contract Item in which the material is intended to be used.

E. No partial payment will be made for stored or stockpiled living or perishable plant materials.

F. The Contractor shall bear all costs associated with the partial payment of stored or stockpiled materials in accordance with the provisions of this Section.

1.16 FINAL PAYMENT

A. When the Work provided for by the Contract has been completely performed on the part of the Contractor and all parts of the Work have been approved by the Engineer and accepted by the Owner, a final estimate will be prepared which shows the total cost of the Work performed under the Contract, including Extra Work as authorized by Change Orders, the total amount retained, and the total amount paid on previous partial estimates. All prior estimates upon which payments have been made are subject to necessary corrections or revisions in the final payment. All pay estimates will be certified as correct by the Engineer and approved by the Owner before payment.

B. The final payment will be made to the Contractor after Final Acceptance by the Owner.

C. Advertisement of completion shall be done in accordance with requirements of Section 01700 – Contract Closeout.

1.17 CLAIMS FOR ADJUSTMENT AND DISPUTES

A. If, for any reason, the Contractor deems that additional compensation is due him for work or materials not clearly provided for in the Contract, Drawings, Specifications, or previously authorized Extra Work, he shall notify the Engineer, in writing, of his intention to claim such additional compensation before he begins the work on which he bases the claim. The Engineer will then make such recommendations, as he sees fit, regarding the validity of the claim to the Owner. It is expressly understood that the Owner shall be the governing body on the validity of any and all claims. No work is to be done without prior written approval of the Engineer. If such notification is not given or the Engineer is not afforded proper opportunity by the Contractor for keeping strict account of actual costs required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor and the fact that the Engineer has kept account of the cost of the Work shall not in any way be construed as proving or substantiating the validity of the claim. When the work on which the claim for additional compensation is based has been completed, the Contractor shall, within ten (10) calendar days, submit his written claim to the Engineer, who will present it to the Owner for consideration in accordance with local laws or ordinances.

B. Nothing in this Section shall be construed as a waiver of the Contractor's right to dispute final payment based on differences in measurements or computations.

1.18 PROHIBITED INTEREST

A. No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept, or approve, or take part in negotiating, making, accepting, or approving, any architectural, engineering, inspection, construction, or material supply contract or any subcontract in connection with the construction of the Project shall become directly or indirectly interested personally in this Contract or in any part thereof. No officer, employee, architect, attorney, engineer, or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory, or other similar functions in connection with the construction of the Project shall become directly or indirectly interested personally in this Contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the Project.

1.19 BUY AMERICAN CLAUSE

A. The Contractor agrees that preference will be given to United States domestically-produced materials and equipment by the Contractor, subcontractors, materialmen, and suppliers in the performance of this Contract.

1.20 DEFECT ASSESSMENT

A. The Contractor shall replace the Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of the Engineer, it is not practical to remove and replace the work, the Engineer will direct one of the following remedies:

1. The defective work may remain, but the unit price/sum will be adjusted to a new price/sum at the discretion of the Engineer.

2. The defective work will be partially repaired to the instructions of the Engineer, and the unit price/sum will be adjusted to a new price/sum at the discretion of the Engineer.

3. The individual Specification Sections may modify these options or may identify a specific formula or percentage price/sum reduction.

1.21 NON-PAYMENT FOR REJECTED PRODUCTS

A. Payment will not be made for any of the following:

1. Products wasted or disposed of in a manner that is not acceptable

2. Products determined as unacceptable before or after placement

3. Products not completely unloaded from the transporting vehicle

4. Products placed beyond the lines and levels of the required Work

5. Products remaining on hand after completion of the Work

6. Loading, hauling, and disposing of rejected products

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SECTION -

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SECTION 01027
APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Format

B. Preparation of Applications

C. Submittal Procedures

D. Substantiating Data

E. Payment Terms

1.02 RELATED SECTIONS

A. Section 00500 – Contract

B. Section 00700 – General Conditions

C. Section 01010 – Summary of Work

D. Section 01015 – Prosecution and Progress

E. Section 01025 – Measurement and Payment

F. Section 01028 – Change Order Procedures

G. Section 01310 – Progress Schedules

H. Section 01700 – Contract Closeout

I. Section 01720 – Project Record Documents

1.03 FORMAT

A. The Contractor shall use the form provided by the Engineer or approved equal. Form shall have a column, for each item, listing: item number, description of work, scheduled value, previous applications, work in-place, authorized Change Orders, total completed to date of application, percent of completion, balance to finish, and retainage.

1.04 PREPARATION OF APPLICATIONS

A. The Contractor shall present required information on electronic media printout.

B. The Contractor shall execute certification by signature of authorized officer.

C. This form to be executed shall serve as the source of the approved Schedule of Values prior to any Application for Payment.

D. The Contractor shall list each authorized Change Order as an extension on the continuation sheet(s), including Change Order number and dollar amount as for an original item of work.

E. The Contractor shall prepare final Application for Payment as specified in Section 01700 – Contract Closeout.

1.05 SUBMITTAL PROCEDURES

A. The Contractor shall submit five (5) signed copies of each Application for Payment, which shall include all required substantiating information (supporting invoices, etc.) as necessary.

B. The Contractor shall submit an updated construction Progress Schedule in accordance with Section 01310 – Progress Schedules with each Application for Payment.

C. The Contractor shall submit at intervals stipulated in the Contract.

D. The Contractor shall sequentially number Applications for Payment.

E. When the Engineer determines that the Application for Payment is proper and correct, he will transmit a Certificate for Payment to the Owner with a copy to the Contractor.

F. Engineer and Owner will not approve any Application for Payment if the Contractor, at the time of review, either has not:

1. Satisfactorily maintained a day-to-day "as-built" record of the construction progress on a full-size set of Contract Drawings in accordance with Section 01720 – Project Record Documents

2. Adequately cleaned and/or restored the site in accordance with Section 01010 – Summary of Work

G. Engineer and Owner will not approve the first Application for Payment if the Contractor has not submitted an acceptable construction video in accordance with Section 01010 – Summary of Work.

1.06 SUBSTANTIATING DATA

A. When the Engineer requires substantiating information, the Contractor shall submit data justifying quantities or dollar amounts in question.

1.07 PAYMENT TERMS

A. The Owner shall make payment to the Contractor within fifteen (15) days upon receipt of the payment request by the Finance Department.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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SECTION 01028
CHANGE ORDER PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Submittals

B. Change Order Procedures

C. Field Directive

D. Stipulated Price (Lump Sum) Change Order

E. Unit Price Change Order

F. Time and Material Change Order

G. Documentation of Change in Contract Price and Contract Time

H. Execution of Change Orders

I. Correlation of Contractor Submittals

1.02 RELATED SECTIONS

A. Section 00500 – Contract

B. Section 00700 – General Conditions

C. Section 01025 – Measurement and Payment

D. Section 01027 – Applications for Payment

E. Section 01310 – Progress Schedules

F. Section 01700 – Contract Closeout

G. Section 01720 – Project Record Documents

1.03 SUBMITTALS

A. The Contractor shall submit the name of the individual authorized to receive Change Order

Documents and be responsible for informing others in the Contractor's employ.

1.04 CHANGE ORDER PROCEDURES

A. Change Orders shall be issued for any item of work defined as "Extra Work" that is to be performed by the Contractor and for any significant increase or decrease in quantities included in the Contract. Change Orders shall be on a form prescribed by the Owner and shall be subject to approval by the Owner.

B. The Engineer shall advise the Contractor of minor changes in the Work, which, in his judgment, do not involve an adjustment of Contract Price or Contract Time as authorized by the General Conditions, by issuing Supplemental Instructions.

C. The Engineer may issue a proposal request, request for change, or notice of change which includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in contract time for executing the change (with a stipulation of any overtime work required), and the period of time during which the requested price will be considered valid. The Contractor shall prepare and submit an estimate within 10 days.

D. The Contractor may propose a change by submitting a request for change to the Engineer, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change and the effect on the Contract price and Contract Time with full documentation.

1.05 FIELD DIRECTIVE

A. The Engineer may issue a field directive, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

B. The field directive shall describe changes in the Work and shall designate the method of determining any change in Contract Sum/Price or Contract Time.

C. The Contractor shall promptly execute the change in Work upon receipt of the field directive.

D. When field directives require an extension in Contract Time, the time extension shall apply only to that work related to the field directive and shall not be utilized by the Contractor for completion of original work items.

1.06 STIPULATED PRICE (LUMP SUM) CHANGE ORDER

A. Change Orders shall be based on proposal request, notice of change or request for change, and Contractor's fixed price quotations, or Contractor's request for a Change Order as approved by the Engineer.

1.07 UNIT PRICE CHANGE ORDER

A. For predetermined unit prices and quantities, the Change Order shall be executed on a fixed unit price basis.

B. For unit costs or quantities of units of work which are not covered in the Contract, the Contractor shall execute the Work under a field directive.

C. Changes in Contract Price or Contract Time shall be computed as specified for time and material Change Order.

D. If any work under such a unit price item is not performed, if only a small percentage of the quantity listed is used, or if the quantity listed is exceeded, the Contractor shall not make any claims for not using said item, for exceeding the stated quantity, or for higher unit prices because of the quantity used or small or high percentage.

1.08 TIME AND MATERIAL CHANGE ORDER

A. After completion of a change, the Contractor shall submit an itemized account and supporting data within time limits indicated in the conditions of the Contract.

B. The Engineer will determine the change allowable in Contract Price and Contract Time as provided in the Contract Documents.

C. The Contractor shall maintain detailed records of Work done on time and material basis.

D. The Contractor shall provide full information required for evaluation of proposed changes to substantiate costs for changes in the Work.

1.09 DOCUMENTATION OF CHANGE IN CONTRACT PRICE AND CONTRACT TIME

A. The Contractor shall maintain detailed records of work done on a time and material basis and provide full information required for evaluation of proposed changes and to substantiate costs of changes in the Work.

B. The Contractor shall document each quotation for a change in cost or time with sufficient and complete data to allow evaluation of the quotation.

C. When requested by the Engineer, the Contractor shall provide additional data to support calculations including:

1. Quantities of products, labor, and equipment
2. Taxes, insurance, and bonds
3. Overhead and profit
4. Justification for any change in Contract Time
5. Credits for deletions from the Contract shall be similarly documented.

D. The Contractor shall support each claim for additional costs and for work done on time and material basis with additional information including:

1. Origin and date of claim
2. Dates and times work was performed and by whom
3. Time records and wage rates paid
4. Invoices and receipts for products, equipment, and subcontractors (similarly documented)

E. The Contractor shall support each claim for additional Contract Time with a detailed time logic analysis in accordance with the requirements of Section 01310 – Progress Schedules.

1.10 EXECUTION OF CHANGE ORDERS

A. The Engineer will issue Change Orders for signatures of parties.

1.11 CORRELATION OF CONTRACTOR SUBMITTALS

A. The Contractor shall promptly revise Schedule of Values and Application for Payment Forms to record each authorized Change Order as a separate line item and adjust the Contract Price.

B. Before resubmitting them, the Contractor shall promptly revise Progress Schedules to reflect any change in Contract Time and revise sub-schedules to adjust time for other items of Work affected by the change.

C. The Contractor shall promptly enter changes in Project Record Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

- END OF SECTION -

SECTION 01040
COORDINATION

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall allow the Owner or his agents, and other project contractors or their agents, to enter upon the work for the purpose of constructing, operating, maintaining, removing, repairing, altering, or replacing such pipes, sewers, conduits, manholes, wires, poles, or other structures and appliances which may be required to be installed at or in the work. The Contractor shall cooperate with all aforesaid parties and shall allow reasonable provisions for the prosecution of any other work by the Owner, or others, to be done in connection with his work, or in connection with normal use of the facilities.

B. The Contractor shall cooperate fully with the Owner, the Engineer, and all other contractors employed on the work, to effect proper coordination and progress to complete the project on schedule and in proper sequence. Insofar as possible, decisions of all kinds required from the Engineer shall be anticipated by the Contractor to provide ample time for inspection or the preparation of instructions.

C. The Contractor shall assume full responsibility for the correlation of all parts of his Work with that of other contractors. The Contractor's superintendent shall correlate all Work with other contractors in the laying out of Work. The Contractor shall lay out his own Work in accordance with the Drawings, Specifications, and instructions of latest issue and with due regard to the work of other contractors.

D. Periodic coordinating conferences shall be held per Section 01200 – Project Meetings, of these Contract Documents.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

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SECTION 01090
REFERENCE STANDARDS

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Wherever reference is made to any published standards, codes, or standard specifications, it shall mean the latest standard code, specification, or tentative specification of the technical society, organization, or body referred to, which is in effect at the date of invitation for Bids.

B. All materials, products, and procedures used or incorporated in the work shall be in strict conformance with applicable codes, regulations, specifications, and standards.

C. A partial listing of codes, regulations, specifications, and standards includes the following:

Air Conditioning and Refrigeration Institute (ARI)

Air Diffusion Council (ADC)

Air Moving and Conditioning Association (AMCA)

The Aluminum Association (AA)

American Architectural Manufacturers Association (AAMA)

American Concrete Institute (ACI)

American Gear Manufacturers Association (AGMA)

American Hot Dip Galvanizers Association (AHDGA)

American Institute of Steel Construction (AISC)

American Iron and Steel Institute (AISI)

American National Standards Institute (ANSI)

American Society of Civil Engineers (ASCE)

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

American Society of Mechanical Engineers (ASME)

American Society for Testing and Materials (ASTM)

American Standards Association (ASA)

American Water Works Association (AWWA)

American Welding Society (AWS)

American Wood Protection Association (AWPA)

Anti-Friction Bearing Manufacturers Association (AFBMA)

Building Officials and Code Administrators (BOCA)

Conveyor Equipment Manufacturers Association (CEMA)

Consumer Product Safety Commission (CPSC)

Factory Mutual (FM)

Federal Specifications

Instrument Society of America (ISA)

Institute of Electrical and Electronics Engineers (IEEE)

National and Local Fire Codes

Lightning Protection Institute (LPI)

National Association of Sewer Service Companies (NASSCO)

National Electrical Code (NEC)

National Electrical Manufacturers Association (NEMA)

National Electrical Safety Code (NESC)

National Electrical Testing Association (NETA)

National Fire Protection Association (NFiPA)

Regulations and Standards of the Occupational Safety and Health Act (OSHA)

Southern Building Code Congress International (SBCCI)

Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

Standard Building Code

Standard Mechanical Code

Standard Plumbing Code

Uniform Building Code (UBC)

Underwriters Laboratories Inc. (UL)

D. Contractor shall, when required, furnish evidence satisfactory to the Engineer that materials and methods are in accordance with such standards where so specified.

E. In the event any questions arise as to the application of these standards or codes, copies shall be supplied on-site by the Contractor.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

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SECTION 01200
PROJECT MEETINGS

PART 1 - GENERAL

1.01 PRE-BID CONFERENCE

A. A Pre-Bid Conference will be held at the time and place to be designated in the Notice to Bidders.

B. The Engineer will be available to discuss the project and answer pertinent questions. No oral interpretation will be made as to the meaning of the Documents. Interpretation, if deemed necessary by the Engineer, will be in the form of an Addendum to the Contract Documents.

1.02 PRECONSTRUCTION MEETING

A. A Preconstruction Meeting will be held after Award of Contract, but prior to starting work at the site.

B. Attendance:

1. Owner

2. Engineer

3. Contractor

4. Major subcontractors

5. Safety representative

6. Representatives of governmental or other regulatory agencies.

C. Minimum Agenda:

1. Tentative construction schedule

2. Critical work sequencing

3. Designation of responsible personnel

4. Processing of Field Decisions and Change Orders

5. Adequacy of distribution of Contract Documents

6. Submittal of Shop Drawings and samples

7. Procedures for maintaining record documents

8. Use of site and Owner's requirements

9. Major equipment deliveries and priorities

10. Safety and first aid procedures

11. Security procedures

12. Housekeeping procedures

13. Processing of Partial Payment Requests

14. General regard for community relations

1.03 PROGRESS MEETING

A. Progress Meetings will be held monthly at a location as selected by the Owner during the performance of the work of this Contract. Additional meetings may be called as progress of work dictates.

B. Engineer will preside at meetings and record minutes of proceedings and decisions. Engineer will distribute copies of minutes to participants.

C. Attendance:

1. Engineer

2. Contractor

3. Major subcontractors, only with Engineer's approval or request, as pertinent to the agenda

D. Minimum Agenda:

1. Review and approve minutes of previous meetings.

2. Review progress of Work since last meeting.

3. Review proposed 30-60 day construction schedule.

4. Note and identify problems which impede planned progress.

5. Develop corrective measures and procedures to regain planned schedule.

6. Revise construction schedule as indicated and plan progress during next work period.

7. Maintaining of quality and work standards.

8. Complete other current business.

9. Schedule next progress meeting.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

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SECTION 01300
SUBMITTALS

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Equipment and Material Orders Schedule

1. Contractor shall prepare and submit five (5) copies of his schedule of principal items of equipment and materials to be purchased to the Engineer for review and approval in accordance with Section 01310 – Progress Schedules.

2. If so required, the schedule shall be revised until it is approved by the Engineer.

3. Schedule shall be updated monthly and five (5) copies submitted to the Engineer not later than the fifth day of every month with the application for progress payment.

4. The updated schedule shall be based on the Progress Schedule developed under Section 01310 – Progress Schedules.

B. Working Drawings

1. Within thirty (30) days after the Notice to Proceed, the Contractor shall prepare and submit five (5) copies of his preliminary schedule of Working Drawing submittals to the Engineer for review and approval. If so required, the schedule shall be revised until it is approved by the Engineer.

2. Working Drawings include, but are not limited to, Shop Drawings, layout drawings in plan and elevation, installation drawings, manufacturer's data, etc. Contractor shall be responsible for securing all of the information, details, dimensions, Drawings, etc., necessary to prepare the Working Drawings required and necessary under this Contract and to fulfill all other requirements of his Contract. Contractor shall secure such information, details, Drawings, etc., from all possible sources including the Drawings, Working Drawings prepared by subcontractors, Engineers, suppliers, etc.

3. Working Drawings shall accurately and clearly present the following:

a. All working and installation dimensions.

b. Arrangement and sectional views.

c. Materials in the proposed positions for installation, details of required attachments and connections, and dimensioned locations between materials and in relation to the structures.

4. In the event that the Engineer is required to provide additional engineering services as a result of a substitution of materials or equipment by the Contractor, the additional services will be provided in accordance with Section 01010 – Summary of Work, and will be covered in supplementary or revised Drawings which will be issued to the Contractor. All changes indicated that are necessary to accommodate the equipment and appurtenances shall be incorporated into the Working Drawings submitted to the Engineer.

5. Working Drawings specifically prepared for this Project shall be on mylar or other approved reproducible material sheets of the same size as the Drawings. Working Drawings shall conform to recognized drafting standards and be neat, legible and drawn to a large enough scale to show in detail the required information.

6. The Drawings are used for engineering and general arrangement purposes only and are not to be used for Working Drawings.

7. Shop Drawings

   a. Contractor shall submit for review by the Engineer Shop Drawings for all fabricated work and for all manufactured items required to be furnished by the Contract Documents.

   b. Structural and all other layout Drawings prepared specifically for the Project shall have a plan scale of not less than 1/4-inch = 1 foot.

   c. Where manufacturer's publications in the form of catalogs, brochures, illustrations or other data sheets are submitted in lieu of prepared Shop Drawings, such submittals shall specifically indicate the item for which approval is requested. Identification of items shall be made in ink, and submittals showing only general information are not acceptable.

8. Layout and Installation Drawings

   a. Contractor shall prepare and submit for review by the Engineer layout and installation drawings for all pipes, valves, fittings, sewers, manhole components, etc., under this Contract. The final dimensions, elevation, location, etc., of pipe, valves, fittings, sewers, manhole components, equipment, etc., may depend upon the dimensions of equipment and materials to be furnished by the Contractor.

   b. Layout and installation drawings are required for piping, valves, fittings, sewers, manhole components, etc.

c. Layout and installation Drawings shall show connections to structures, pipes, fittings, etc.

d. Drawings shall show the location and type of all supports, hangers, foundations, etc.

9. Contractor Responsibilities

a. All submittals from subcontractors, manufacturers or suppliers shall be sent directly to the Contractor for checking. Contractor shall thoroughly check all Drawings for accuracy and conformance to the intent of the Contract Documents. Drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors, manufacturers, or suppliers by the Contractor for correction before submitting them to the Engineer.

b. All submittals shall be bound, dated, properly labeled and consecutively numbered. Information on the label shall indicate Specification Section, Drawing number, subcontractor's, manufacturer's or supplier's name and the name or type of item the submittal covers. Each part of a submittal shall be marked and tabulated.

c. Working Drawings shall be submitted as a single complete package including all associated drawings relating to a complete assembly of the various parts necessary for a complete unit or system.

d. Shop Drawings shall be submitted as a single complete package for any operating system and shall include all items of equipment and any mechanical units involved or necessary for the functioning of such system.

e. ALL SUBMITTALS SHALL BE THOROUGHLY CHECKED BY THE CONTRACTOR FOR ACCURACY AND CONFORMANCE TO THE INTENT OF THE CONTRACT DOCUMENTS BEFORE BEING SUBMITTED TO THE ENGINEER AND SHALL BEAR THE CONTRACTOR'S STAMP OF APPROVAL CERTIFYING THAT THEY HAVE BEEN SO CHECKED. SUBMITTALS WITHOUT THE CONTRACTOR'S STAMP OF APPROVAL WILL NOT BE REVIEWED BY THE ENGINEER AND WILL BE RETURNED TO THE CONTRACTOR.

f. If the submittals contain any departures from the Contract Documents, specific mention thereof shall be made in the Contractor's letter of transmittal. Otherwise, the review of such submittals shall not constitute approval of the departure.

g. No materials or equipment shall be ordered, fabricated, shipped or any work performed until the Engineer returns to the Contractor the submittals, herein required, annotated "Furnish as Submitted", "Furnish as Corrected", or

"Furnish as Corrected – Confirm." If a submittal is returned "Furnish as Corrected – Confirm" the portions of work covered by the submittal that require confirmation by the Engineer shall not be ordered, fabricated, shipped, or any work performed until those portions are approved in a subsequent submittal either "Furnish as Submitted" or "Furnish as Corrected".

h. Where errors, deviations, and/or omissions are discovered at a later date in any of the submittals, the Engineer's prior review of the submittals does not relieve the Contractor of the responsibility for correcting all errors, deviations, and/or omissions.

10. Procedure for Review

a. Submittals shall be transmitted in sufficient time to allow the Engineer at least thirty (30) working days for review and processing.

b. Contractor shall transmit seven (7) hard copies and three (3) electronic copies of all technical data or drawings to be reviewed. Electronic copies of both preliminary and final Shop Drawings shall be submitted in accordance with the following requirements:

i. Electronic copies shall be in Adobe Acrobat® Portable Document Format (*.pdf), Version 1.3 or more recent, shall be searchable, shall be submitted on CD-ROM, and shall be suitable for downloading into the Owner's Infor database system. Electronic copies shall be PDF Formatted Text and Graphics (formerly Normal) format or PDF Searchable Image (formerly Image+Text) format. PDF Image Only format is not acceptable. If submitted in PDF Searchable Image format, the Optical Character Recognition shall be at a 95% confidence level, using Adobe Acrobat® Capture® 3.x or an equivalent product.

ii. All Bill of Material sheets and/or tables indicating product data, quantities, physical location and reference, catalog number, reference, cost, and any other field entered in the bill of materials sheet and/or any other spreadsheets and/or any other table and/or listings of references, etc., shall all be electronically developed and submitted in a database format, using current version of either Microsoft® Excel or Microsoft® Access software. This applies to all summary sheets, material listings, etc., to be submitted for this Project. Submittals shall include hard copies and an electronic version developed in current version of either Microsoft® Excel or Microsoft® Access software. Electronic version shall be submitted on CD-ROM.

iii. Binders and File Organization of the Electronic Copies: Clearly label each CD-ROM copy of the electronic version. The CD-ROM volume

numbers, content and organization of the electronic files contained within, and labeling formats shall match and shall be identical to those of the hard copies. All labels shall be neatly typed and labeled. Handwritten labels shall not be accepted. Organize electronic copies in a hard-plastic case with locking and hinged cover. Install a neatly typed label on each case that shall provide all the information required to be listed on the cover by these Specifications.

c. Submittal shall be accompanied by a letter of transmittal containing date, project title, Contractor's name, number and titles of submittals, a list of relevant specification sections, notification of departures from any Contract requirement, and any other pertinent data to facilitate review.

d. Submittals will be annotated by the Engineer in one of the following ways:

"Furnish as Submitted" (FAS) - no exceptions are taken

"Furnish as Corrected" (FAC) - minor corrections are noted and shall be made.

“Furnish as Corrected – Confirm” (FACC) - some corrections are noted and a partial resubmittal or additional information are required as specifically requested.

"Revise and Resubmit" (R&R) - major corrections are noted and a full resubmittal is required.

"For Information Only – Not Reviewed” (FIO) – submittal was received and was distributed for record purposes without review.

e. If a submittal is satisfactory to the Engineer in full or in part, the Engineer will annotate the submittal "Furnish as Submitted", "Furnish as Corrected", or “Furnish as Corrected – Confirm”, retain four (4) hard copies and two (2) electronic copies and return remaining copies to the Contractor. If reproducible transparencies are submitted, the Engineer will retain the copies and return the reproducible transparencies to the Contractor. In the case of “Furnish as Corrected – Confirm” a partial resubmittal or additional information are required as specifically requested.

f. If a full resubmittal is required, the Engineer will annotate the submittal "Revise and Resubmit" retain three (3) hard copies and one (1) electronic copy and return remaining copies to the Contractor. If reproducible transparencies are submitted, the Engineer will retain the copies and return the reproducible transparencies to the Contractor.

g. Contractor shall continue to resubmit submittals in part if they are returned “Furnish as Corrected – Confirm” or in full if they are returned “Revise and

Resubmit" as required by the Engineer until submittals are acceptable to the Engineer. It is understood by the Contractor that Owner may charge the Contractor the Engineer's charges for review in the event a submittal is not approved (either "Furnish as Submitted" or "Furnish as Corrected") by the second submittal (first re-submittal) for a system or piece of equipment. These charges shall be for all costs associated with engineering review, meetings with the Contractor or manufacturer, etc., commencing with the third submittal (second re-submittal) of a system or type of equipment submitted for a particular Specification Section.

h. Acceptance of a Working Drawing by the Engineer will constitute acceptance of the subject matter for which the Drawing was submitted and not for any other structure, material, equipment or appurtenances indicated or shown.

11. Engineer's Review

a. Engineer's review of the Contractor's submittals shall in no way relieve the Contractor of any of his responsibilities under the Contract. An acceptance of a submittal shall be interpreted to mean that the Engineer has no specific objections to the submitted material, subject to conformance with the Contract Drawings and Specifications.

b. Engineer's review will be confined to general arrangement and compliance with the Contract Drawings and Specifications only, and will not be for the purpose of checking dimensions, weights, clearances, fittings, tolerances, interferences, coordination of trades, etc.

12. Record Working Drawings for Project Record Documents

a. Project Record Documents shall be in accordance with Section 01720 – Project Record Documents.

b. Prior to final payment, the Contractor shall furnish the Engineer one complete set of all accepted Working Drawings, including Shop Drawings, for equipment, piping, manhole components, etc.

c. Working Drawings furnished shall be corrected to include any departures from previously accepted Working Drawings.

C. Samples

1. Contractor shall furnish for review all samples as required by the Contract Documents or requested by the Engineer.

2. Samples shall be of sufficient size or quantity to clearly illustrate the quality, type, range of color, finish or texture and shall be properly labeled to show the nature of

the material, trade name of manufacturer and location of the work where the material represented by the sample will be used.

3. Samples shall be checked by the Contractor for conformance to the Contract Documents before being submitted to the Engineer and shall bear the Contractor's stamp of approval certifying that they have been so checked. Transportation charges on samples submitted to the Engineer shall be prepaid by the Contractor.

4. Engineer's review will be for compliance with the Contract Documents and his comments will be transmitted to the Contractor with reasonable promptness.

5. Accepted samples will establish the standards by which the completed work will be judged.

PART 2 - PRODUCTS
(NOT USED)

PART 3 - EXECUTION
(NOT USED)

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SECTION 01310
PROGRESS SCHEDULES

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor's approach to prosecution of the Work shall be disclosed to the Engineer by submission of computerized, cost-and-resource loaded CPM Progress Schedules as required in this Section. These requirements are in addition to, and not in limitation of, those imposed elsewhere in the Specifications.

B. A Pay Activity, as opposed to a CPM Activity, is an Activity used to simplify cost-loading of the Progress Schedule. When used, Pay Activities shall be loaded with the cost of Work that is included, at no cost, in related (generally, concurrent) CPM Activities. Pay Activities shall not control the rate of progress; however, their start and finish dates shall be consistent with those of their related CPM Activities to ensure accurate Early Date and Late Date payment plots. References to CPM (Critical Path Method) shall be CPM standards consistent with this Section.

1.02 PROGRESS SCHEDULE SUBMITTALS

A. Progress Schedule Submittals shall include a disk with the Contractor's files, a narrative and seven (7) copies of the following reports, schedules, and plots, all in formats, sorts, and sequences acceptable to the Engineer.

1. Detailed Cost Breakdown

2. Activity Reports

3. Equipment and Material Order Schedule

4. Short Term Schedule

5. Logic Diagram

6. Resource Plots

B. The Contractor shall uniquely identify each Progress Schedule Submittal. Resubmissions shall be identified by reusing the corresponding Submittal number and the letter A, B, etc., and shall fully address all the Engineer's Comments and objections.

C. No Progress Schedule review by the Engineer shall relieve the Contractor from the responsibility to: (1) comply with the Contract Times and any sequences of Work indicated in or required by the Contract Documents, and (2) complete omitted Work within the Contract

Times. Nor will any such Progress Schedule review by the Engineer lead to approval of, or consent to, any variation from the Contract Documents, except as the Engineer may otherwise approve or consent to individual variations by means of specific, separate notations in writing.

D. The Contractor shall submit the Preliminary Progress Schedule as stated in the Instruction to Bidders. This shall constitute the Rev. 0 Progress Schedule and shall meet all the submittal requirements specified herein.

E. Once the Rev. 0 Progress Schedule is approved, it shall become the Rev. 0 Record Schedule or As-Planned Schedule, and shall be used for Progress Payment submittals until the Record Schedule is revised by subsequent Progress Schedules.

F. The Contractor shall not submit Progress Payments Requests until the Rev. 0 Progress Schedule is approved.

G. The Contractor shall submit monthly Progress Schedule revisions (Rev.1, Rev. 2, etc.) with each monthly Progress Payment Request. Updated Progress Schedules shall be submitted a minimum of 7 days in advance of each construction progress meeting along with a detailed 30 day look ahead schedule.

H. Each monthly Progress Schedule shall be intended to document those agreements reached between the Owner and the Contractor concerning the Progress Schedule by incorporating revisions in activities, logic ties, and so forth, agreed to by the Owner upon completion of the Engineer's review of any preceding Proposal Schedule submittals made by the Contractor.

I. The Contractor shall submit Proposal Schedules, which shall support proposals or claims for changes in Contract Price or Contract Time, schedule recovery plans and other Contractor-initiated Progress Schedule adjustments. A Proposal Schedule Submittal shall include all the reports, schedules, plots, etc. specified for a Progress Schedule Submittal.

1.03 DELAY PROVISIONS

A. The Contractor shall promptly take appropriate action to recover schedule whenever the Contractor anticipates, or any Progress Schedule Submittal demonstrates, and required CPM Activity to slip, due to acts or omissions within the control of the Contractor, by fifteen (15) or more days beyond any Target Time or Contract Time. If the Contractor is not responsible for such schedule slippage, the Contractor shall give prompt written notice of a delay justifying a Contract Time extension, and follow such notice by taking prompt appropriate action nonetheless, if so directed by the Engineer.

1. If schedule recovery is required, the Contractor shall enclose with the next Progress Schedule Submittal a schedule recovery plan consisting of (1) a narrative describing the cause of schedule slippage and the actions taken to recover schedule within the shortest reasonable time, and (2) a Proposal Schedule with the corresponding revisions in Activities and logic ties and other adjustments. Appropriate schedule recovery actions may include assignment of additional labor, subcontractors or construction

equipment; Work during other than normal working hours; resequencing of the Work; expediting of Submittals and deliveries; and any combination of any of these or other similar actions. Activity shortening and overlapping shall be explained as to their basis (and be supported by increases in resources).

2. If the Contractor believes that an increase in Contract Time is justified, any such extension in Contract Time and associated increase in Contract Price will not be evaluated, unless the following requisites are met: (1) the Contractor, using the procedures in this Section, demonstrates that conditions justifying extensions in Contract Time or increases in Contract Price, or both, have arisen, and (2) the Contractor's analysis is verifiable by an independent, objective evaluation by the Engineer, using the electronic files and data furnished by the Contractor.

B. The Contractor's failure, refusal, or neglect to take appropriate schedule recovery action or, in the alternative, give written notice of a delay, and, in either case, to follow up with a timely Proposal Schedule shall be reasonable evidence that the Contractor is not prosecuting the Work with due diligence. Any such Contractor failure, refusal, or neglect shall give sufficient basis to the Owner, with the Engineer's advice, to elect any of the following: (1) demand adequate, written assurance of due performance, (2) withhold liquidated damages, and (3) in the Owner's sole discretion, direct alternate schedule recovery actions.

C. Once the As-Planned Schedule is established, the Engineer will select Progress Points. Progress Points will be assigned Target Times using the Late Dates in the Rev. 0 Record Schedule (As-Planned Schedule). As the Record Schedule is revised, Target Times shall be revised to reflect the Late Dates. Target Times shall be interim, Contractor-imposed deadlines; however, Target Times shall not be Contract Times.

D. In the event the Engineer is unable to approve any Progress Schedule Revision, both the Engineer and Contractor shall be required to use the Rev. 0 Record Schedule and Rev. 0 Target Times, and not any disputed Record Schedule, to resolve issues affecting Contract Time and Contract Price, as follows: (1) The As-Planned Schedule will be updated through several Progress Payment closing dates, and (2) actual dates for the Progress Points shall be compared with the Rev. 0 Target Times, and any slippage, by trade or equivalent Contract phase, shall be correspondingly explained.

1. Any such updating of the As-Planned Schedule through a closing date (1) shall purposely exclude all Contractor-initiated revisions affecting Work after the closing date, even if such revisions were incorporated into any Revision Submittal, but (2) shall include adjustments in Activities and logic tie changes covering changes and delays that were consented to by the Owner before the closing date. Adjustments in Activities and logic ties for Contractor-initiated revisions (including schedule recovery plans) shall be incorporated only in the update for the period when the Work reflected by those Contractor-initiated revisions actually took place.

1.04 PROGRESS SCHEDULE SOFTWARE

A. The Progress Schedule software shall be current version of Primavera Project Planner® that runs on IBM PC compatible equipment and is capable of: (1) processing and plotting the required Progress Schedule information, and (2) creating data bases accessible by other software.

1.05 MEASUREMENT AND PAYMENT

A. The Contractor represents to have included in the Contract Price all costs for Work under this Section. Payment for Work performed under this Section will be made as part of those payments made on in-progress and completed Detailed Cost Breakdown pay items, or using the Earned Values for Progress Schedule Submittal pay items, if any such pay items are established.

PART 2 - PRODUCTS

2.01 PROGRESS SCHEDULE; NARRATIVE

A. The Progress Schedule shall detail CPM Activities and logic ties to the extent required to show the Contractor's overall approach to the Work.

B. The Progress Schedule shall clearly define the prosecution of the Work from Notice to Proceed to Final Acceptance by using separate CPM Activities for, but not limited to: construction/installation; permitting (by the Contractor and Owner); submittal preparation; submittal review and return; submittal resubmissions and submittal re-reviews, as advisable; deliveries to the site or storage; Owner-furnished items; interfaces with other work (other contractors, public utilities, etc.); testing and Punch List; Owner training; and start-up.

C. CPM Activity durations shall equate to the days required to complete the associated work. Activities shall not combine: (a) separate items of Unit Price or lump sum work; (b) distinct classes of work (e.g., CSI Divisions or equivalent); (c) work in separate areas, structures or facilities and, if requested by the Engineer, work in separate locations or elevations within an area, structure or facility; or (d) rough-in and finish work.

D. Installation CPM Activities shall last from fifteen (15) to forty-five (45) days, unless a shorter duration results from the rules in Article 2.01, Paragraph C. Unless longer review times are specified in other Specifications, Submittal review CPM Activities also shall last a minimum of fifteen (15) working days as determined by the Engineer. Submittal, delivery, and start-up CPM Activities may combine materials and equipment in the same class of work, based on the detail of related installation CPM Activities.

E. Activities shall be assigned consistent descriptions, codes, and sort codes. Sort code schemes shall: be subject to the Engineer's prior consent; indicate whether the Contractor (or a subcontractor or Supplier), Engineer, or Owner the lead; distinguish CPM Activities from pay Activities; and group Activities by unit price, area, change, Submittals, deliveries and other such schemes. Constraint dates shall be explained as to bases.

F. The narrative shall list the CPM Activities on each Critical Path and compare Early and Late Dates for CPM Activities designating Contract Times and Target Times. The narrative shall also recap progress and days gained or lost vs. the current Record Schedule, describe changes in resources to be used on remaining Work and identify delays, their extent and causes. The narrative shall also itemize changes in Activities, logic ties and DCB pay items by each change, recovery plan and Contractor-initiated revision.

2.02 REPORTS; SCHEDULES; PLOTS

A. Activity Reports shall include CPM Activity code, description, duration, calendar, Early and Late Dates (calendar dates), Total Float, labor manhours, and sort codes. The Late Finish Date (or the Early Start Date) of any CPM Activity highlighting a Contract Time (or commencement of all or any part of the Work) shall equal the corresponding Contract Time (or Contract date). In addition, for precedence-based Progress Schedules, Activity Reports shall show, for each CPM Activity, all preceding and succeeding logic ties (lead/lag and lead times) or attach a separate report combining such Activity and logic tie data.

B. Equipment and Material Order Schedule shall be submitted in accordance with Section 01300 – Submittals and shall be in tabular form with appropriate spaces to include the following information for principal items of equipment and materials:

1. Dates on which Shop Drawings are requested and received from the manufacturer.

2. Dates on which certification is received from the manufacturer and transmitted to the Engineer.

3. Dates on which Shop Drawings are submitted to the Engineer and returned by the Engineer for revision.

4. Dates on which Shop Drawings are revised by manufacturer and resubmitted to the Engineer.

5. Date on which Shop Drawings are returned by Engineer annotated either "Furnish as Submitted" or "Furnish as Corrected".

6. Date on which accepted Shop Drawings are transmitted to manufacturer.

7. Date of manufacturer’s scheduled shop test.

8. Date of manufacturer's scheduled delivery.

9. Date on which delivery is actually made.

C. The Detailed Cost Breakdown (DCB) shall divide the Work into pay items by significant Sections of the Specifications within areas, structures, and facilities, or vice versa. If

requested by the Engineer in writing, there shall be separate DCB reports for self-performed Work and the Work of each Subcontractor.

1. Pay Activities or the features of the software shall be used to ensure that any total CPM Activity Value or, if appropriate, that any Activity labor, Subcontract, etc. Values roll up to only one DCB pay item. Once the Rev. 0 DCB is approved, the Contractor shall not modify any DCB pay item or Activity Value, unless otherwise authorized by the Engineer in writing.

D. Short-Term Schedules shall subdivide CPM Activities into detailed tasks and cover the prior two (2) weeks and the next four (4) weeks. Each installation task shall be cross-referenced to a CPM Activity and shall not combine the Work for more than one crew. Submittals shall segregate preparation from review and shall not combine items furnished by separate Suppliers.

E. Logic Diagrams shall be arrow or precedence and, once the Engineer has designated time-scales, shall be plotted on a time- scaled calendar, on 22-inch x 34-inch sheets. Logic Diagrams shall identify the Contract Times and Critical Path(s). CPM Activities shall be shown on the Early Dates, and Total Floats shall be noted beside the CPM Activities. Logic connectors, whether on the same sheet or not, shall identify predecessors and successors.

F. Resource Plots shall graph monthly (or weekly, if chosen by the Engineer) and cumulative payments and manpower, using current Early Dates and Late Dates and, when requested by the Engineer, comparing As-Planned Schedule and current Early Dates. The specific trades shall be chosen by the Engineer.

PART 3 - EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01370
SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 REQUIREMENT INCLUDED:

A. Procedures for preparation and submittal of Schedule of Values.

1.02 RELATED REQUIREMENTS:

A. Drawings, Technical Specification Sections, General and Supplementary Conditions of the Contract and other Division 00 and Division 01 Specifications Sections, apply to this Section.

B. Specifications throughout all Divisions of the Project Manual are directly pertinent to this Section, and this Section is directly pertinent to them.

1.03 RELATED SECTIONS: Specified Sections elsewhere may include but are not limited to:

A. Section 00700: General Conditions.

B. Section 01027: Applications for Payment.

C. Section 01300: Submittals.

1.04 FORMAT:

A. Type on Jefferson County Environmental Services Department (JCESD) provided forms or approved format.

1.05 CONTENT:

A. List installed value of each major item of work and each subcontracted item of work as a separate line item to serve as a basis for computing values for Progress Payments. Round off values to nearest dollar.

B. Coordinate listings with Progress Schedule.

C. For items on which payments will be requested for stored products, list sub-values for cost of stored products.

D. Submit a sub-schedule for each separate stage of work specified in the project manual.

E. The sum of values listed shall equal total Contract or lump sum price items.

1.06 SUBMITTALS:

A. Submit Preliminary Schedule of Values within fifteen (15) days after the tentative award of the Contract.

B. Submit finalized Schedule of Values within ten (10) days from the approval date of the Overall Construction Progress Schedule.

C. Submit one (1) digital copy of Schedule.

1.07 SUBSTANTIATING DATA:

A. When JCESD requires substantiating information, submit data justifying line item amounts in question.

1.08 ACTION:

A. No payment will be made for work performed on a lump sum contract or a lump sum item until the appropriate Schedule of Values is approved by the Owner

B. The equitable value of work deleted from a lump sum contract or lump sum item shall be determined from the approved Schedule of Values

PART 2 - PRODUCTS
(NOT USED)

PART 3 - EXECUTION
(NOT USED)

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. Work for Schedule of Values shall not be measured separately for payment.

4.02 PAYMENT:

A. No separate payment will be made for work under this Section. The cost thereof shall be distributed among the appropriate items specified in the technical sections of these specifications.

- END OF SECTION -

SECTION 01400
QUALITY CONTROL

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Testing Laboratory Services

1. Laboratory testing and checking required by the Specifications, including the cost of transporting all samples and test specimens, shall be provided and paid for by the Contractor unless otherwise indicated in the Specifications.

2. Materials to be tested include, but are not necessarily limited to the following: cement, concrete aggregate, concrete, bituminous paving materials, structural and reinforcing steel, waterproofing, select backfill, crushed stone or gravel and sand.

3. Tests required by the Owner shall not relieve the Contractor from the responsibility of supplying test results and certificates from manufacturers or suppliers to demonstrate conformance with the Specifications.

4. Procedure

a. The Contractor shall plan and conduct his operations to permit taking of field samples and test specimens, as required, and to allow adequate time for laboratory tests.

b. The collection, field preparation and storage of field samples and test specimens shall be as directed by the Engineer with the cooperation of the Contractor.

5. Significance of Tests

a. Test results shall be binding on both the Contractor and the Owner, and shall be considered irrefutable evidence of compliance or noncompliance with the Specification requirements, unless supplementary testing shall prove, to the satisfaction of the Owner, that the initial samples were not representative of actual conditions.

6. Supplementary and Other Testing

a. Nothing shall restrict the Contractor from conducting tests he may require. Should the Contractor at any time request the Owner to consider such test

results, the test reports shall be certified by an independent testing laboratory acceptable to the Owner. Testing of this nature shall be conducted at the Contractor's expense.

1.02 IMPERFECT WORK, EQUIPMENT, OR MATERIALS

A. Any defective or imperfect work, equipment, or materials furnished by the Contractor which is discovered before the Final Acceptance of the Work, as established by the Certificate of Substantial Completion, or during the subsequent guarantee period, shall be removed immediately even though it may have been overlooked by the Engineer and estimated for payment. Any equipment or materials condemned or rejected by the Engineer shall be tagged as such and shall be immediately removed from the site. Satisfactory work or materials shall be substituted for that rejected.

B. The Engineer may order tests of imperfect or damaged work, equipment, or materials to determine the required functional capability for possible acceptance, if there is no other reason for rejection. The cost of such tests shall be borne by the Contractor; and the nature, tester, extent and supervision of the tests will be as determined by the Engineer. If the results of the tests indicate that the required functional capability of the work, equipment, or material was not impaired, consistent with the final general appearance of same, the work, equipment, or materials may be deemed acceptable. If the results of such tests reveal that the required functional capability of the questionable work, equipment, or materials has been impaired, then such work, equipment, or materials shall be deemed imperfect and shall be replaced. The Contractor may elect to replace the imperfect work, equipment, or material in lieu of performing the tests.

1.03 INSPECTION AND TESTS

A. The Contractor shall allow the Engineer ample time and opportunity for testing materials and equipment to be used in the work. He shall advise the Engineer promptly upon placing orders for material and equipment so that arrangements may be made, if desired, for inspection before shipment from the place of manufacture. The Contractor shall at all times furnish the Engineer and his representatives, facilities including labor, and allow proper time for inspecting and testing materials, equipment, and workmanship. The Contractor must anticipate possible delays that may be caused in the execution of his work due to the necessity of materials and equipment being inspected and accepted for use. The Contractor shall furnish, at his own expense, all samples of materials required by the Engineer for testing, and shall make his own arrangements for providing water, electric power, or fuel for the various inspections and tests of structures and equipment.

B. Where other tests or analyses are specifically required in other Sections of these Specifications, the cost thereof shall be borne by the party (Owner or Contractor) so designated in such Sections. The Owner will bear the cost of all tests, inspections, or investigations undertaken by the order of the Engineer for the purpose of determining

conformance with the Contract Documents if such tests, inspection, or investigations are not specifically required by the Contract Documents, and if conformance is ascertained thereby. Whenever nonconformance is determined by the Engineer as a result of such tests, inspections, or investigations, the Contractor shall bear the full cost thereof or shall reimburse the Owner for said cost. In this connection, the cost of any additional tests and investigations, which are ordered by the Engineer to ascertain subsequent conformance with the Contract Documents, shall be borne by the Contractor.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

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SECTION 01455
LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Laws to be Observed

B. Permits, Licenses, and Taxes

C. Patented Devices, Materials, and Processes

D. Responsibility for Safety

E. Sanitary, Health, and Safety Precautions

F. Public Convenience and Safety

G. Protection and Restoration of Property

H. Responsibility for Damage Claims

I. Third Party Beneficiary Clause

J. Use of a Section or Portion of the Work

K. Privileges of the Contractor in Streets, Alleys, and Rights-of-Way

L. Railway and Highway Crossings

M. Personal Liability of Public Officials

N. No Waiver of Legal Rights

O. Environmental Protection

P. Archeological and Historical Findings

1.02 RELATED SECTIONS

A. Section 01560 – Temporary Environmental Controls

B. Section 01570 – Traffic Regulations

C. Section 31 32 00 – Slope Protection and Erosion Control

1.03 LAWS TO BE OBSERVED

A. The Contractor shall be and remain fully informed of all federal and state laws, all local laws, ordinances, regulations, and all orders and decrees of bodies or tribunals having any jurisdiction or authority which in any manner affect those engaged or employed in the Work, or which in anyway affect the conduct of the Work. He shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees and shall protect and indemnify the Owner and all his officers, agents, or servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by the Contractor or his employees.

1.04 PERMITS, LICENSES, AND TAXES

A. The Contractor shall procure all permits and licenses, including those permits required by the Owner, pay all charges or fees, as applicable, and give all notices necessary and incident to the due and lawful prosecution of the Work. There shall be no charge for building permits obtained from the Owner when the Contractor is building a structure for the Owner.

1.05 PATENTED DEVICES, MATERIALS, AND PROCESSES

A. The Contractor shall hold and save the Owner and its officers, agents, servants, and employees harmless from liability of any nature or kind, including cost and expenses for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the Contract, including its use by the Owner, unless otherwise specifically stipulated in the Contract Documents.

B. If the Contractor uses any design, device, or materials covered by letters, patent, or copyright, he shall provide for such use by suitable agreement with the owner of such patented or copyrighted design, device, or material. It is mutually agreed and understood that, without exception, the Contract prices shall include all royalties or costs arising from the use of such design, device, or materials in any way involved in the Work. The Contractor and/or his sureties shall indemnify and save harmless the Owner from any and all claims for infringement by reason of the use of such patented or copyrighted design, device, or materials or any trademark or copyright in connection with Work agreed to be performed under this Contract and shall indemnify the Owner for any cost, expense, or damage which it may be obligated to pay by reason of such infringement at any time during the prosecution of the Work or after completion of the Work.

1.06 RESPONSIBILITY FOR SAFETY

A. The Contractor, in the prosecution of his Work under this Contract, is bound by the

requirements of "Safety and Health Regulations for Construction" of OSHA, the U.S. Government Department of Labor, and of other authorities having jurisdiction in safety matters.

B. Under the terms and conditions of this Contract, the Engineer and/or the Owner shall not act as safety engineer or safety supervisor since such responsibility remains solely with the Contractor. The Engineer and/or the Owner shall not be responsible for establishing safety practices or for prescribing safety measures for the Contractor.

C. The Contractor is solely and completely responsible for conditions of the job site, including safety of all persons and property affected directly or indirectly by his operations during the performance of the Work, and this requirement is not limited in application to normal working hours, but applies continuously twenty-four (24) hours per day until acceptance of the Work by the Engineer, and thereafter shall be subject to the terms and conditions of the Guaranty.

D. The duty of the Owner and the Engineer to review the Work in order to determine its acceptability in accordance with the Specifications and to conduct construction review of the Contractor's performance for the benefit of the Owner shall not be construed as a duty to review the adequacy of the Contractor's safety measures on or near the construction site and/or to direct the actions of the Contractor's employees in the performance of the Work as such a duty is not included in the responsibilities of the Owner and the Engineer.

1.07 SANITARY, HEALTH, AND SAFETY PRECAUTIONS

A. The Contractor shall provide and maintain in a neat, sanitary condition such accommodations for the use of his employees as may be necessary to comply with the requirements of the State and Local Board of Health or of other bodies or tribunals having jurisdiction. These accommodations shall be properly secluded from public observation. The Contractor is reminded that the guidelines set forth by OSHA shall be the minimum that will govern working conditions during construction.

B. Attention is directed to federal, state, and local laws, rules, and regulations concerning construction safety and health standards. The Contractor shall not require any worker to work in surroundings or under conditions which are unsanitary, hazardous, or dangerous to his health or safety.

C. All chemicals used during construction of the Project or furnished for Project operation, whether herbicide, pesticide, disinfectant, polymer, reagent, or of other classification, must show approval by the EPA, USDA, or FDA according to the purpose for such chemicals. The disposal of residues therefrom are subject to the instructions of the manufacturers of the respective chemicals.

1.08 PUBLIC CONVENIENCE AND SAFETY

A. The Contractor shall control his operations and those of his subcontractors and all

suppliers to assure the least inconvenience to the traveling public. Under all circumstances, safety shall be the most important consideration.

B. Where the Work is located in or near streets, alleys, or highway right-of-ways, the Contractor shall store construction materials and perform the Work in such a manner as will provide adequate and satisfactory convenience for the general public and residents along the Work.

C. The Contractor shall contact all utilities affected by his Work and coordinate with them such that fire, police, sanitation services, etc. will not be adversely affected.

D. Storage of materials and the Work shall be arranged so that there shall be free access to all fire hydrants, valves, manholes, and other utility appurtenances.

E. The Contractor shall take such precautionary measures in the performance of the Work as will give maximum protection at all times to persons and property near the Work.

1.09 PROTECTION AND RESTORATION OF PROPERTY

A. The Contractor shall not enter upon private property except right-of-way easements for any purpose without first obtaining written permission from its owner and lessees, and he shall be responsible for the preservation of, and shall use every precaution necessary to prevent damage to, all trees, shrubbery, fences, culverts, bridges, pavement, driveways, sidewalks, etc.; all water, sewer, gas, telephone, electric lines, and other utilities thereof; and all other public or private property along or adjacent to the Work. The Contractor shall notify the proper representatives of any public service corporation, any company, or any individual not less than twenty-four (24) hours in advance of any work which might damage or interfere with the operation of their property along or adjacent to the Work. The Contractor shall be responsible for all damage or injury to property of any character resulting from any act, omission, neglect, or misconduct in the manner or method of executing the Work or due to his non-execution of the Work or at any time due to defective work or materials.

B. The Contractor shall be responsible for the preservation of all public and private property, shall carefully protect all land monuments and property marks from disturbance or damage until the Engineer has witnessed or otherwise referenced their location, and shall not move these monuments and marks until directed by the Engineer.

C. When and where any direct or indirect damage or injury is done to public or private property on account of any act, omission, neglect, or misconduct in the execution of the Work or in consequence of the non-execution thereof on the part of the Contractor, he shall immediately restore, at his expense, such property to a condition equal to or better than that existing before such damage or injury occurred, by repairing, rebuilding, or otherwise restoring as may be directed by the Engineer, or the Contractor shall make good such damage or injury in a manner acceptable to the injured property owner.

1.10 RESPONSIBILITY FOR DAMAGE CLAIMS

A. The Contractor shall indemnify and save harmless the Engineer and the Owner and their officers and employees from all suits, actions, or claims of any character brought because of any injuries or damage received or sustained by any person, persons, or property on account of the operations of the Contractor; or on account of or in consequence of any neglect in safeguarding the Work; or through use of unacceptable materials in constructing the Work; or because of any act, omission, neglect, or misconduct of said Contractor; or because of any claims or amounts recovered from any infringements of patent, trademark, or copyright; or from any claims or amounts arising or recovered under the "Workmen's Compensation Act", or any other law, ordinance, order, or decree. Money due the Contractor under and by virtue of this Contract as may be considered necessary by the Owner for such purpose may be retained for the use of the Owner or, in case no money is due, his surety may be held until such suit or suits, action or actions, or claim or claims for injuries or damages as aforesaid shall have been settled and suitable evidence to that effect furnished to the Owner, except that money due the Contractor will not be withheld when the Contractor produces satisfactory evidence that he is adequately protected by public liability and property damage insurance.

B. The Owner shall not be liable to the Contractor for damages or delays resulting from work by third parties or by injunctions or other restraining orders obtained by third parties, except that time will not be charged during such delays, as provided in Section 01015 – Prosecution and Progress.

1.11 THIRD PARTY BENEFICIARY CLAUSE

A. It is specifically agreed between the parties executing the Contract that it is not intended by any of the provisions of any part of the Contract to create the public or any member thereof as a third party beneficiary or to authorize anyone not a party to the Contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of the Contract.

1.12 USE OF A SECTION OR PORTION OF THE WORK

A. Whenever, in the opinion of the Engineer, any portion of the Work or structure is in suitable condition, it may be put into use upon the written order of the Engineer, and such usage shall not be held to be in any way an acceptance of the Work or structure or any part thereof as a waiver of any of the provisions of these Specifications or Contract. Pending completion and Final Acceptance of the Work, all necessary repairs and renewals of any section of the Work so put into use due to defective material or workmanship, to natural causes other than ordinary wear and tear, or to the operation of the Contractor shall be performed by, and at the expense of, the Contractor. Warranty on equipment and structures shall begin on the date of Final Acceptance of the Work by the Owner; use or occupancy by the Owner will not constitute a waiver of this requirement.

1.13 PRIVILEGES OF THE CONTRACTOR IN STREETS, ALLEYS, AND RIGHTS-OF-WAY

A. For the performance of the Contract, the Contractor will be permitted to occupy such portions of the public property as will not unduly restrict traffic or endanger the public. The Contractor will ensure that such occupancy of public property shall be in accordance with traffic control plans developed for the Project.

1.14 RAILWAY AND HIGHWAY CROSSINGS

A. Where the Work encroaches upon the right-of-way of any railway, public highway, or other public utility, the Owner will obtain all easements or authority necessary to enter upon such right-of-way for the prosecution and completion of the Work, but the Contractor shall make all arrangements with the owner of the right-of-way for the actual construction work, shall perform the work on or across the right-of-way in the manner and at the times agreed upon with the right-of-way owner, and shall pay the costs thereof, including the costs, if any, of temporary construction performed by the right-of-way owner as a means of providing safe and continuous operation of its facilities during the construction period. The Contractor shall take extra precautions for the safety of the Work, the right-of-way facilities, and the general public as may be necessary by sheeting, bracing, and thoroughly supporting the sides of any excavation and supporting and protecting any adjacent structures.

B. Where required by any railway or highway owner, the Contractor shall post with the Owner thereof such bonds or insurance as may be required to guarantee the satisfactory replacement or repair of materials, paving, or grading within the right-of-way thereof.

1.15 PERSONAL LIABILITY OF PUBLIC OFFICIALS

A. In carrying out any of the Contract provisions or in exercising any power or authority granted to him by this Contract, there shall be no liability upon the Engineer, his authorized representatives, or any official of the Owner, either personally or as an official of the Owner. It is understood that in such matters they act solely as agents and representatives of the Owner.

1.16 NO WAIVER OF LEGAL RIGHTS

A. Upon completion of the Work, the Owner will expeditiously make a final inspection and notify the Contractor of Final Acceptance. Such Final Acceptance, however, shall not preclude the Owner from correcting any measurement, estimate, or certificate made before or after completion of the Work, nor shall the Owner be precluded from recovering from the Contractor or his surety, or both, such overpayment as may be sustained by failure on the part of the Contractor to fulfill his obligations under the Contract. A waiver on the part of the Owner of any breach of any part of the Contract shall not be held to be a waiver of any other or subsequent breach.

B. The Contractor, without prejudice to the terms of the Contract, shall be liable to the Owner for latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards to the Owner's rights under any warranty or guaranty.

1.17 ENVIRONMENTAL PROTECTION

A. The Contractor shall comply with all Federal, State, and Local laws and regulations controlling pollution of the environment. He shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, bitumens, chemicals, or other harmful materials and pollution of the atmosphere from particulate and gaseous matter.

1.18 ARCHAEOLOGICAL AND HISTORICAL FINDINGS

A. Should the Contractor encounter, during his operations, any building, part of a building, structure, or object which appears to be of historical or archaeological significance, he shall immediately cease operations in that location and notify the Engineer. The Engineer will immediately investigate the Contractor's finding and will direct the Contractor to either resume his operations or to suspend operations as directed.

B. Should the Engineer order suspension of the Contractor's operations in order to protect an archaeological or historical finding or order the Contractor to perform extra work, such shall be covered by an appropriate Contract modification (Change Order) as provided in Section 01028 – Change Order Procedures. If appropriate, the Contract modification shall include an extension of Contract Time in accordance with the requirements of Section 01015 – Prosecution and Progress.

PART 2 - PRODUCTS

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PART 3 - EXECUTION

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SECTION 01505
MOBILIZATION AND DEMOBILIZATION

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Mobilization shall include the obtaining of all permits, moving equipment onto the site, furnishing and erecting temporary buildings and other construction facilities if required, fees, insurance, and bonds, all as required for the proper performance and completion of the Work. Mobilization shall include the following principal items:

1. Moving on to the site all of Contractor's equipment, materials, tools, etc. required for operations

2. Arranging for and erection of Contractor's work and storage area

3. Obtaining all required permits and licenses

4. Having all OSHA required notices and establishment of safety programs

5. Having the Contractor's superintendent at the job site full time

6. All special scheduling necessary to complete the Work in an orderly manner

7. Moving materials, equipment, tools, and labor throughout the project site due to space restrictions

B. Demobilization shall include the removal of personnel, equipment, supplies, and incidentals from the Project site; the removal of all buildings and other facilities that were necessary for work on the Project; and the performance of other work or costs incurred after acceptable completion of construction operations on the Project.

1.02 PAYMENT FOR MOBILIZATION AND DEMOBILIZATION

A. The Contractor's attention is directed to the condition that no payment for mobilization or any part thereof will be approved for payment under the Contract until all mobilization items previously listed herein have been completed as specified.

B. As soon as practicable after receipt of the Notice to Proceed, the Contractor shall submit a breakdown to the Engineer for approval, which shall show the estimated value of each major component of standard mobilization.

C. The lump sum price bid for mobilization and demobilization shall be limited to 5 percent of the total Contract amount. Any amount that exceeds 5 percent of the total Contract amount shall be included with other items of the Work.

D. Partial payment for mobilization and demobilization shall be made on the following basis:

1. Mobilization shall constitute 60 percent of the total lump sum bid for Bid Item No. 1 – Mobilization and Demobilization. Partial payments will be made in two equal or approximately equal payments as follows:

a. The first payment will be made on the first Application for Payment as long as the work performed to date on other Contract pay items exceeds $50,000.00.

b. The second payment will be made on the first Application for Payment after the Contractor has earned five (5) percent or more of the total Contract amount for other pay items. Both payments will be simultaneously made when the requirements listed in both Article 1.02, Paragraph D, Item 1, Sub-paragraphs a and b are met at the same time.

2. Demobilization shall constitute 40 percent of the total lump sum bid for Bid Item No. 1 – Mobilization and Demobilization. Payment for demobilization will only be authorized after Final Acceptance of the Project.

E. Partial payment for bonds, insurance, and permit fees is not subject to the limitations previously specified herein.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01510
TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall provide temporary light and power, water, and sanitary facilities as required for his operations at the Project site. The temporary services shall be provided for use throughout the construction period.

B. The Contractor shall coordinate and install all temporary services in accordance with the requirements of the utility companies having jurisdiction and as required by applicable codes and regulations. All temporary systems shall comply with and meet the approval of the local authorities having jurisdiction.

C. At the completion of the work, or when the temporary services are no longer required, the facilities shall be restored to their original conditions.

D. All costs in connection with the temporary services including, but not limited to, installation, utility company service charges, maintenance, relocation, and removal shall be borne by the Contractor at no additional cost to the Owner.

E. Some temporary facilities that may be required may be indicated on the Drawings; however, the Drawings do not necessarily show any or all of the temporary facilities that the Contractor ultimately uses to complete the work.

F. At all times during performance of the Work, the Contractor shall be held entirely responsible for the security of all temporary utilities used for his operations at the Project site.

G. Temporary Light and Power

1. The temporary general lighting and small power requirements shall be serviced by 120/240 V, 1 phase, 3 wire temporary systems furnished and installed by the Contractor. This service shall be furnished complete with main disconnect, overcurrent protection, meter outlet, branch circuit breakers, and wiring as required; including branch circuit breakers and wiring as required for furnishing temporary power, all in accordance with the requirements of the servicing power company and applicable standards and codes. The meter for the temporary 120/240 V service for construction purposes shall be registered in the name of the Contractor and all energy charges for furnishing this temporary electric power shall be borne by the Contractor. Any Contractor with a need for power other than the 120/240 V, 1 phase, 3 wire shall provide such power at his own expense.

2. The Contractor shall make all necessary arrangements, and pay for all permits, inspections, and power company charges for all temporary service installations. All temporary systems shall comply with and meet the approval of the local authorities having jurisdiction. All temporary electrical systems shall consist of wiring, switches, necessary insulated supports, poles, fixtures, sockets, receptacles, lamps, guards, cutouts, and fuses as required to complete such installations. The Contractor shall furnish lamps and fuses for all temporary systems furnished by him and shall be responsible for replacing broken and burned out lamps, blown fuses, damaged wiring, etc. as required to maintain these systems in adequate and safe operating condition. All such temporary light and power systems shall be installed without interfering with the work of any other contractors working at the site of the Project at that time.

3. When it is necessary during the progress of construction that a temporary electrical facility installed under this Division interferes with construction operations, the Contractor shall relocate the temporary electrical facilities to maintain temporary power as required at no additional cost to the Owner. The Contractor shall be responsible at all times for any damage or injury to equipment, materials, or personnel caused by improperly protected, maintained, or installed temporary installations and equipment during performance of the Work.

4. The various subcontractors doing the work at the site shall be permitted to connect into the temporary general lighting system small hand tools, such as drills, hammers, and grinders, provided that:

    a. Equipment and tools are suitable for 120 V, 1 phase, 60 Hz operation and operating input does not exceed 1,500 volt-amperes.

    b. Tools are connected to outlets of the system with only one (1) unit connected to a single outlet.

    c. In case of overloading of circuits, the Contractor will restrict use of equipment and tools as required for correct loading.

5. The Contractor shall keep the temporary general lighting and power systems energized fifteen minutes before the time that the earliest trade starts in the morning and de-energized fifteen minutes after the time the latest trade stops. This applies to all weekdays, Monday through Friday, inclusive, which are established as regular working days.

6. Any Contractor requiring temporary light and power before or after the hours set forth hereinbefore, or on a Saturday, Sunday, or holiday, shall pay for the additional cost of keeping the system energized and repaired. If it is necessary for the Contractor or his employees to be in any structure after regular working hours and the temporary general lighting system is not required for illumination, that Contractor shall provide such illumination required by means of flashlights, electric lanterns, or other devices not requiring use of electricity from the temporary general lighting system.

7. Each subcontractor requiring additional power and lighting other than that specified herein (including power for temporary heating equipment to be provided by the Contractor) shall furnish his own service complete with all fuses, cutouts, wiring and other material and equipment necessary for a complete system between the service point and the additional power consumers and shall install his own metering equipment in accordance with the requirements of the servicing power company.

8. Upon completion of the Work, but prior to acceptance by the Owner, the Contractor shall remove all temporary services, security lighting systems, temporary general lighting systems, and all temporary electrical work from the premises.

H. Temporary Sanitary Service

1. Sanitary conveniences, in sufficient numbers, for the use of all persons employed on the work and properly screened from public observation, shall be provided and maintained at suitable locations by the Contractor, all as prescribed by State Labor Regulations and local ordinances. The contents of same shall be removed and disposed of in a manner consistent with local and state regulations, as the occasion requires. Contractor shall rigorously prohibit the committing of nuisances within, on, or about the work. Sanitary facilities shall be removed from the site when no longer required.

I. Temporary Water

1. The Contractor shall provide temporary water for construction purposes, sanitary facilities, fire protection, cleaning, flushing, testing, etc. The Contractor shall make all arrangements for connections to the potable water system at the Project site. The Contractor shall comply with all requirements of the individual utility companies having local jurisdiction over the potable water system in the areas where the Project is located and as required by applicable codes and regulations, including requirements for backflow prevention.

2. The Contractor shall be responsible for contacting and coordinating with each individual utility company to obtain a fire hydrant meter for measuring the amount of water used during performance of the work. The Contractor shall pay all charges associated with the connection and all charges assessed by the utility companies for potable water used under this Contract.

3. The Contractor shall supply potable water for his employees either by portable containers or drinking fountains.

4. An adequate number of hose bibbs, hoses, and watertight barrels shall be provided for the distribution of water.

5. Water service shall be protected from freezing and the service shall be extended and relocated as necessary to meet temporary water requirements.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01520
WORKING AROUND EXISTING UTILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Working Around Existing Utilities

1.02 RELATED SECTIONS

A. Division 31 – Earthwork

1.03 WORKING AROUND EXISTING UTILITIES

A. Gas lines for the transmission or distribution of natural, manufactured, or liquefied petroleum gas are dangerous to work around. Accidents can be caused by direct damage to these gas mains or service lines during construction or by settlement in the trenches or settlement of structures after construction is completed. The Contractor shall take every possible precaution to minimize the hazards of working in proximity to gas lines and shall be solely responsible for any damage to them or for any injury to persons or damage to property arising from or caused by his operations.

B. No excavation or other work shall be done by the Contractor within a gas pipeline right-of-way or within ten feet of a gas transmission line until the owner of the gas line has been notified not less than 48 hours in advance of such work and until the gas line has been exposed by the Contractor sufficiently to determine its exact horizontal and vertical location. In addition, the owner of the gas line shall be allowed to keep a qualified representative present while any construction work that could damage such line is being done. Methods of excavation specified by the owner of the utility must be adhered to by the Contractor.

C. Where work is to be done in areas served by medium- and low-pressure gas distribution systems, the owner of such system shall be notified by the Contractor not less than 24 hours in advance before such work is started, and such owner shall be given the opportunity to keep a representative present during this construction work or to locate and stake out all gas lines. In such case, the Contractor shall cooperate with the representative of the owner of the gas lines to avoid damage to them.

D. Should any gas main or service line or other gas facility be damaged during the construction Work, the following minimum precautions shall be taken by the Contractor:

1. Stop all construction work that could cause any further damage to the gas facilities or hazards to other personal property.

2. Give adequate warning to any persons who could be injured or owners of any property that could be damaged and take other necessary safety precautions.

3. Immediately notify the owner of the gas facility of the nature and location of such damage.

4. Permanent repairs shall be made by the owner of the gas facility or by the Contractor to the owner's satisfaction and approval. Any repairs made by the Contractor shall be in accordance with ASME B31.8 "Gas Transmission and Distribution Piping Systems", latest edition. The inspector or representative of the Engineer does not have the responsibility or authority to supervise or inspect repairs to damaged gas facilities.

E. No structure shall be constructed over or immediately adjacent to a gas pipeline or gas facility or within the gas line easement. Gas pipelines shall not pass through manholes or other sewer structures. When sanitary sewer lines cross over gas lines, the minimum cover, which is the vertical distance between the outside top and outside bottom of the two pipelines, shall be as specified by the owner of the gas line. In both cases, this cover space shall be carefully backfilled with thoroughly compacted selected material as required by the property owner. Where gas lines cross pipe trenches, the excavated space below such gas lines shall also be carefully backfilled with thoroughly compacted crushed stone.

F. Other utilities such as water lines, steam lines, electrical lines, telephone lines, television cable, and telegraph lines, whether overhead or underground, shall be carefully preserved by the Contractor.

G. In the event that interference with any existing utilities is imminent, the Contractor shall so notify the owner of the utility 48 hours in advance of any construction activities so that service may be relocated or otherwise preserved and protected.

H. The Contractor shall fully cooperate with the representative of the utility company to the extent necessary to satisfactorily accomplish the Work.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01525
WORKING WITHIN THE RIGHTS-OF-WAY OF HIGHWAYS, RAILWAYS, OR STREETS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Working Within the Rights-of-Way of Highways, Railways, or Streets

B. Special Construction

1.02 RELATED SECTIONS

A. Section 01570 – Traffic Regulation

B. Division 31 – Earthwork

1.03 WORKING WITHIN THE RIGHTS-OF-WAY OF HIGHWAYS, RAILWAYS, OR STREETS

A. In the event a sewer or manhole to be replaced crosses, runs parallel to, or runs alongside any highway, county road, city street, or railroad right-of-way, the Contractor shall obtain a utility permit from the governing body affected. The Owner's utility permit provisions are printed below:

1. The applicant named hereon is responsible for adequately and properly protecting the public from loss or injury due to the work permitted. The following shall constitute proper protection:

a. The applicant must comply with the Alabama Manual on Uniform Traffic Control Devices. All devices must be in place prior to start of construction and shall be properly maintained by applicant during construction.

b. The applicant shall assume all liability, protect, and save harmless the Owner and its employees or agents from any and all claims originating from this work and from any and all liability or claims arising from its use or occupancy of said area covered in this revocable permit. Whenever any person or corporation making any excavation in the street, highway, or alley fails to backfill in the proper manner as required by these Specifications, then the local governing body shall cause the work to be done and the cost thereof shall be charged against the bond as required by these Specifications.

2. If the work contemplated requires a road to be temporarily closed, an inspection on the ground by the Engineer or his duly authorized representative will be necessary before a permit is issued.

3. Public or private service corporations shall furnish a map 8-1/2 inches by 11 inches or multiples thereof in duplicate showing location of utility to be installed. No map is required on individual services.

4. This permit may be revoked at any time by the Owner, either during the progress of the Work or at any time after the completion of the Work, if the provisions under which this permit was issued are not complied with or the provisions of any applicable ordinance are not complied with. The Contractor also agrees that he will remove any part or all of any installation made under this permit at no cost to the Owner if such removal is ordered by the Owner.

5. A bond, as required by the right-of-way owner and/or Plumbing, Gas, or Electrical Code, may be required of any applicant for a permit to excavate in any public easement or right-of-way.

6. The permit is limited to the interests and rights of the Owner in and to the area involved without warranty.

7. This permit, if granted, shall constitute an agreement and warranty on the applicant that all work required will be done in a good and workmanlike manner to be approved by the Owner and at the sole expense of the applicant. Where the valuation of any work proposed under this permit does not exceed $3,000.00, the work shall commence within thirty (30) calendar days, otherwise the permit shall become void.

8. The applicant shall be responsible for any and all drainage problems resulting from the work done hereto, shall be obligated to promptly complete the work in the area covered by this permit subject to the approval of the Engineer, and shall restore the land and easements in as good of a condition as before the work was commenced.

9. All excavations shall be as small in area as practical. Ditches shall be neatly cut with the sides kept vertical. Ample shoring shall be furnished and maintained where necessary. Material for backfilling shall be placed in six (6)-inch horizontal layers. Each layer shall be carefully tamped until completely compacted before adding the next layer. Incompressible backfill material (sand, slag, crushed stone, or gravel) will be required in all cuts that are made in pavement. In addition, permanent patch of a minimum of two (2) inches of plant mix will be required immediately after backfilling is completed. If municipality requires more than two (2) inches of plant mix, Contractor shall provide additional plant mix at no additional cost to the Owner. In cuts that are within three (3) feet of the edge of pavement, if, in the opinion of the Engineer, the

excavated materials are unsuitable for tamping, suitable materials shall be provided by the Contractor to backfill, and all unsuitable material shall be disposed of by the Contractor. Upon completion of backfilling, trenches shall be inspected by the Engineer before the workmen leave the job. At least 24 hours notice shall be given to the Engineer prior to the time such inspection is desired. In all cuts made in concrete, the applicant shall backfill as provided above and shall repair or replace with new concrete of the same thickness as that of the existing concrete, but not less than four (4) inches minimum thickness.

10. This utility permit must be kept on the job while work is in progress.

1.04 SPECIAL CONSTRUCTION

A. Where the Work requires special stream or railroad crossings or any other extraordinary conditions, or where alternate types of construction are used that are not covered by these Specifications, the materials and construction methods shall be as shown on the Drawings and as specified in the Special Conditions.

PART 2 - PRODUCTS

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PART 3 - EXECUTION

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SECTION 01530
PROTECTION OF EXISTING FACILITIES

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Contractor shall be responsible for the preservation and protection of property adjacent to the work site against damage or injury as a result of his operations under this Contract. Any damage or injury occurring on account of any act, omission, or neglect on the part of the Contractor shall be restored in a proper and satisfactory manner or replaced by and at the expense of the Contractor to an equal or superior condition than previously existed.

B. Contractor shall comply promptly with such safety regulations as may be prescribed by the Owner or the local authorities having jurisdiction and shall, when so directed, properly correct any unsafe conditions created by, or unsafe practices on the part of, his employees. In the event of the Contractor's failure to comply, the Owner may take the necessary measures to correct the conditions or practices complained of, and all costs thereof will be deducted from any monies due the Contractor. Failure of the Engineer to direct the correction of unsafe conditions or practices shall not relieve the Contractor of his responsibility hereunder.

C. In the event of any claims for damage or alleged damage to property as a result of work under this Contract, the Contractor shall be responsible for all costs in connection with the settlement of or defense against such claims. Prior to commencement of work in the vicinity of property adjacent to the work site, the Contractor, at his own expense, shall take such surveys as may be necessary to establish the existing condition of the property. Before final payment can be made, the Contractor shall furnish satisfactory evidence that all claims for damage have been legally settled or sufficient funds to cover such claims have been placed in escrow, or that an adequate bond to cover such claims has been obtained.

1.02 PROTECTION OF WORK AND MATERIAL

A. During the progress of the Work and up to the date of final payment, the Contractor shall be solely responsible for the care and protection of all work and materials covered by the Contract.

B. All work and materials shall be protected against damage, injury, or loss from any cause whatsoever, and the Contractor shall make good any such damage or loss at his own expense. Protection measures shall be subject to the approval of the Engineer.

1.03 BARRICADES, WARNING SIGNS, AND LIGHTS

A. Contractor shall provide, erect, and maintain as necessary, strong and suitable barricades, danger signs, and warning lights along all roads accessible to the public, as required by the authority having jurisdiction, to ensure safety to the public. All barricades and obstructions along public roads shall be illuminated at night, and all lights for this purpose shall be kept burning from sunset to sunrise.

B. Contractor shall provide and maintain such other warning signs, lights, and barricades in areas of and around their respective work as may be required for the safety of all those employed in the work, the Owner's operating personnel, or those visiting the site.

1.04 EXISTING UTILITIES AND STRUCTURES

A. The term existing utilities shall be deemed to refer to both publicly-owned and privately-owned utilities such as electric power and lighting, telephone, water, gas, storm drains, process lines, sanitary sewers and all appurtenant structures.

B. Where existing utilities and structures are indicated on the Drawings, it shall be understood that all of the existing utilities and structures affecting the work may not be shown and that the locations of those shown are approximate only. It shall be the responsibility of the Contractor to ascertain the actual extent and exact location of existing utilities and structures. In every instance, the Contractor shall notify the proper authority having jurisdiction and obtain all necessary directions and approvals before performing any work in the vicinity of existing utilities.

C. Prior to beginning any excavation work, the Contractor shall, through field investigations, determine any conflicts or interferences between existing utilities and new utilities to be constructed under this project. This determination shall be based on the actual locations, elevations, slopes, etc., of existing utilities as determined in the field investigations, and locations, elevation, slope, etc. of new utilities as shown on the Drawings. If an interference exists, the Contractor shall bring it to the attention of the Engineer as soon as possible. If the Engineer agrees that an interference exists, he shall modify the design as required. Additional costs to the Contractor for this change shall be processed through a Change Order as detailed elsewhere in these Contract Documents. In the event the Contractor fails to bring a potential conflict or interference to the attention of the Engineer prior to beginning excavation work, any actual conflict or interference which does arise during the Project shall be corrected by the Contractor, as directed by the Engineer, at no additional expense to the Owner.

D. The work shall be carried out in a manner to prevent disruption of existing services and to avoid damage to the existing utilities. Temporary connections shall be provided, as required, to insure uninterruption of existing services. Any damage resulting from the work of this Contract shall be promptly repaired by the Contractor at his own expense in a manner approved by the Engineer and further subject to the requirements of any authority having jurisdiction. Where it is required by the authority having jurisdiction that they perform their

own repairs or have them done by others, the Contractor shall be responsible for all costs thereof.

E. Where excavations by the Contractor require any utility lines or appurtenant structures to be temporarily supported and otherwise protected during the construction work, such support and protection shall be provided by the Contractor. All such work shall be performed in a manner satisfactory to the Engineer and the respective authority having jurisdiction over such work. In the event the Contractor fails to provide proper support or protection to any existing utility, the Engineer may, at his discretion, have the respective authority to provide such support or protection as may be necessary to insure the safety of such utility, and the costs of such measures shall be paid by the Contractor.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

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SECTION 01540
DEMOLITION AND REMOVAL OF EXISTING STRUCTURES AND EQUIPMENT

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. This Section covers the demolition, removal, and disposal of existing structures, pavement, curbs, sidewalk, manholes, and piping and removal and disposal of asbestos materials required during performance of the Work as indicated on the Drawings and as specified hereinafter. The Contractor shall furnish all labor, materials, and equipment to demolish structures and to remove anchors, supports, piping, and accessories designated to be removed on the Drawings or as directed by the Engineer.

1.02 TITLE TO EQUIPMENT AND MATERIALS

A. Contractor shall have no right or title to any of the equipment, materials, or other items to be removed from the Project site unless and until said equipment, materials, and other items have been removed from the premises. The Contractor shall not sell or assign, or attempt to sell or assign any interest in, the said equipment, materials, or other items until the said equipment, materials, or other items have been removed.

B. Contractor shall have no claim against the Owner because of the absence of such materials.

1.03 CONDITION OF STRUCTURES AND EQUIPMENT

A. The Owner does not assume responsibility for the actual condition of structures and equipment to be demolished and removed.

B. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner so far as practicable.

C. The information regarding the existing structures and equipment shown on the Drawings is based on visual inspection and a walk-through survey only. Neither the Engineer nor the Owner will be responsible for interpretations or conclusions drawn therefrom by the Contractor.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 DEMOLITION AND REMOVALS

A. The removal of all equipment and all materials from the demolition of structures shall, when released by the Owner and Engineer, be performed by the Contractor, and these items shall become the Contractor's property, unless otherwise noted, for disposition in any manner not contrary to the Contract requirements and shall be removed from the site to the Contractor's own place of disposal.

B. The Contractor shall proceed with the removal of the equipment, materials, and appurtenances from the demolished structures and the structures themselves, or portions thereof, in a sequence designed to maintain the sanitary sewer collection system in continuous operation as described in Section 02600 – Wastewater Flow Control, and shall proceed only after approval of the Engineer.

C. Any equipment, piping, and appurtenances removed without proper authorization which are necessary for the operation of the existing sanitary sewer collection system shall be replaced to the satisfaction of the Engineer at no cost to the Owner.

D. Excavation caused by demolitions shall be backfilled with fill free from rubbish and debris.

3.02 PROTECTION

A. Demolition and removal work shall be performed by competent experienced workmen for the various type of demolition and removal work and shall be carried out through to completion with due regard to the safety of Owner employees, workmen onsite, and the public. The work shall be performed with as little nuisance as possible.

B. The work shall comply with the applicable provisions and recommendation of ANSI A10.2, Safety Code for Building Construction, all governing codes, and as hereinafter specified.

C. The Contractor shall make such investigations, explorations, and probes as are necessary to ascertain any required protective measures before proceeding with demolition and removal. The Contractor shall give particular attention to shoring and bracing requirements so as to prevent any damage to new or existing construction.

D. The Contractor shall provide, erect, and maintain catch platforms, lights, barriers, weather protection, warning signs, and other items as required for proper protection of the public, workmen engaged in demolition operations, and adjacent construction.

E. The Contractor shall provide and maintain weather protection at exterior openings so as to fully protect the interior premises against damage from the elements until such openings are closed by new construction.

F. The Contractor shall provide and maintain temporary protection of the existing structure designated to remain where demolition, removal, and new work is being done, connections made, materials handled, or equipment moved.

G. The Contractor shall take necessary precautions to prevent dust from rising by wetting demolished masonry, concrete, plaster, and similar debris.

H. The Contractor shall provide adequate fire protection in accordance with local Fire Department requirements.

I. The Contractor shall not close or obstruct walkways, passageways, or stairways and shall not store or place materials in passageways, stairs, or other means of egress. The Contractor shall conduct operations with minimum traffic interference.

J. The Contractor shall be responsible for any damage to the existing structure or contents by reason of the insufficiency of protection provided.

3.03 WORKMANSHIP

A. The demolition and removal work shall be performed as described in the Contract Documents. The work required shall be done with care, and shall include all required shoring, bracing, etc. The Contractor shall be responsible for any damage which may be caused by demolition and removal work to any part or parts of existing structures or items designated for reuse or to remain. The Contractor shall perform patching, restoration, and new work in accordance with applicable Technical Sections of the Specifications and in accordance with the details shown on the Drawings. Prior to starting of work, the Contractor shall provide a detailed description of methods and equipment to be used for each operation and the sequence thereof for review by the Engineer.

B. All openings in concrete shall be closed in a manner meeting the requirements of the appropriate Sections of these Specifications, as shown on the Drawings, and as directed and approved by the Engineer.

C. Materials or items designated to remain the property of the Owner shall be as hereinafter tabulated. Such items shall be removed with care and stored at a location to be designated by the Owner.

D. Material or items damaged during removal shall be replaced with similar new material or items. Any equipment that is removed without proper authorization and is required for sanitary sewer collection system operation shall be replaced at no cost to the Owner.

E. Materials or items demolished and not designated to become the property of the Owner or to be reinstalled shall become the property of the Contractor and shall be removed from the property and legally disposed of.

F. The Contractor shall execute the work in a careful and orderly manner, with the least possible disturbance to the public.

G. In general, masonry shall be demolished in small sections, and where necessary to prevent collapse of any construction, the Contractor shall install temporary shores, struts, and bracing.

H. Where alterations occur, or new and old work join, the Contractor shall cut, remove, patch, repair, or refinish the adjacent surfaces to the extent required by the construction conditions, so as to leave the altered work in as good a condition as existed prior to the start of the work. The materials and workmanship employed in the alterations, unless otherwise shown on the Drawings or specified, shall comply with that of the various respective trades which normally perform the particular items or work.

I. The Contractor shall finish adjacent existing surfaces to new work to match the specified finish for new work. The Contractor shall clean existing surfaces of dirt, grease, loose paint, etc., before refinishing.

J. The Contractor shall cut out embedded anchorage and attachment items as required to properly provide for patching and repair of the respective finishes.

K. The Contractor shall remove temporary work, such as enclosures, signs, guards, and the like when such temporary work is no longer required or when directed at the completion of the work.

3.04 MAINTENANCE

A. The Contractor shall maintain the structures and public properties free from accumulations of waste, debris, and rubbish caused by the demolition and removal operations.

B. The Contractor shall provide on-site dump containers for collection of waste materials, debris, and rubbish, and he shall wet down dry materials to lay down and prevent blowing dust.

C. At reasonable intervals during the progress of the demolition and removal work or as directed by the Engineer, the Contractor shall clean the site and properties, and dispose of waste materials, debris, and rubbish.

3.05 EQUIPMENT AND MATERIALS TO BE RETAINED BY OWNER

A. The following equipment and materials will be retained by the Owner:

1. All manhole frames and covers removed by the Contractor but not reinstalled

B. The previously-listed equipment and materials shall be moved by the Contractor to storage areas to be designated by the Owner.

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SECTION 01550
SITE ACCESS AND STORAGE

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Access Roads

1. The Contractor shall construct and maintain such temporary access roads as required to perform the work of this Contract.

2. Access roads shall be located within the property lines or existing permanent easements of the Owner unless the Contractor independently secures easements for his use and convenience. Contractor shall submit written documentation to the Engineer for any Contractor-secured easements across privately-held property. Easement agreement shall specify terms and conditions of use and provisions for site restoration. A written release from the property owner certifying that all terms of the easement agreement have been completed by the Contractor shall be furnished to the Engineer prior to final payment.

3. Existing access roads used by the Contractor shall be suitably maintained by the Contractor at his expense during construction. Contractor shall not be permitted to restrict Owner access to existing facilities. Engineer may direct Contractor to perform maintenance of existing access roads when Engineer determines that such work is required to insure all-weather access by the Owner.

4. The Contractor shall obtain and pay all costs associated with any bonds required by the Alabama Department of Transportation for the use of State-maintained roads.

B. Parking Areas

1. The Contractor shall be responsible for constructing and maintaining suitable parking areas for his construction personnel on the Project site where approved by the Engineer and the Owner.

C. Restoration

1. At the completion of the Work, the surfaces of land used for access roads and parking areas shall be restored by Contractor to its original condition and to the satisfaction of the Engineer. At a minimum, such restoration shall include establishment of a permanent ground cover adequate to restrain erosion for all disturbed areas.

D. Traffic Regulations

1. Contractor shall obey all traffic laws and comply with all the requirements, rules, and regulations of the Alabama Department of Transportation and other local authorities having jurisdiction to maintain adequate warning signs, lights, barriers, etc., for the protection of traffic on public roadways.

E. Storage of Equipment and Materials

1. Contractor shall store his equipment and materials at the Project site in accordance with the requirements of the General Conditions, the Special Conditions, and as hereinafter specified. All equipment and materials shall be stored in accordance with manufacturer's recommendations and as directed by the Owner or Engineer, and in conformity to applicable statutes, ordinances, regulations, and rulings of the public authority having jurisdiction.

2. Contractor shall enforce the instructions of Owner and Engineer regarding the posting of regulatory signs for loadings on structures, fire safety, and smoking areas.

3. Contractor shall not store materials or encroach upon private property without the written consent of the owners of such private property.

4. Contractor shall not store unnecessary materials or equipment on the Project site, and shall take care to prevent any structure from being loaded with a weight which will endanger its security or the safety of persons.

5. Materials shall not be placed within ten (10) feet of fire hydrants. Gutters, drainage channels, and inlets shall be kept unobstructed at all times.

6. Contractor shall provide adequate temporary storage buildings/facilities, if required, to protect materials or equipment on the job site.

7. At all times during performance of the Work, Contractor shall be held entirely responsible for the security of all Contractor-provided equipment, materials, etc. being temporarily stored or staged.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01560
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Dust Control

1. Contractor shall take all necessary measures to control dust from his operations and to prevent spillage of excavated materials on public roads.

2. Contractor shall remove all spillage of excavated materials, debris, or dust from public roads by methods approved by the Engineer.

3. Contractor shall sprinkle water at locations and in such quantities and at such frequencies as may be required by the Engineer to control dust and prevent it from becoming a nuisance to the surrounding area.

4. Dust control and cleaning measures shall be provided at no additional cost to the Owner.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

- END OF SECTION -

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SECTION 01570
TRAFFIC REGULATION

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Work may require traffic control plans to protect the public and the Contractor's work force. The Contractor shall be responsible for contacting any and all agencies for stipulations regarding traffic control measures and shall be responsible for the development and submission to the proper authorities of any required traffic control plans. The Contractor shall be responsible for furnishing, operating, maintaining, moving, and relocating all required construction traffic control devices including, but not limited to, stationary construction signs for advance warning and detours, Type III barricades, portable temporary traffic control devices, flashing arrow panels, and lights that may be required as a condition of Federal, state, or local requirements.

1.02 RELATED SECTIONS

A. Section 01010 – Summary of Work

B. Section 01015 – Prosecution and Progress

C. Section 01560 – Temporary Environmental Controls

D. Section 32 12 16 – Asphalt Paving

E. Section 32 13 13 – Portland Cement Concrete Paving

1.03 SUBMITTALS

A. For all construction that may affect the flow of traffic, the Contractor shall submit a detailed Traffic Control Plan to the appropriate municipality(-ies) and entity(-ies) having jurisdiction over the specific street, road, or highway where the traffic control and regulation will occur for review and approval. The Contractor shall also submit all Traffic Control Plans to the Engineer and Owner for their review and records in accordance with Section 01300 – Submittals. Traffic Control Plan shall include:

1. Identification and location of all signage, cones, lights, barriers, flow of traffic arrows, flagmen, confirmation that all devices are visible, duration of traffic disruption, detours, driveway blocking, etc.

2. Outline of permit acquisition procedure for lane closures

3. Methods for proper signing and barricades in compliance with local requirements and the Owner's requirements

4. Contractor's emergency phone numbers

B. All Traffic Control Plans for work located within the City of Birmingham must be sealed by a Professional Engineer registered in the State of Alabama if the Plans include the closing or detouring of any roadways. Contractor shall be responsible for determining if any other municipalities in which the Work occurs will require that Traffic Control Plans for work located within their municipality must be sealed by a Professional Engineer registered in the State of Alabama.

PART 2 - PRODUCTS

2.01 CONSTRUCTION TRAFFIC CONTROL DEVICES

A. Description: The work covered by this Section consists of furnishing, erecting, maintaining, relocating, and removing traffic control devices in accordance with the Specifications, MUTCD, or as required by local jurisdictions and/or as directed by the Engineer. The MUTCD referred to in this provision shall be the current edition of the Manual on Uniform Traffic Control Devices for Streets and Highways, as prepared by the National Advisory Committee on Uniform Traffic Control Devices, including all standard documents referred to in the second paragraph of Section 1A-7 of the MUTCD. The current edition shall be the edition current on the date of advertisement for the Project. All traffic control devices furnished by the Contractor shall remain the property of the Contractor, unless otherwise required by the Contract. Traffic control devices shall include, but not be limited to signs, non-metallic drums, barricades, cones, delineators, temporary guardrail, temporary pavement marking, raised reflective pavement markers, flaggers, and pilot vehicles, as required.

B. Materials: Unless otherwise required, materials used in the fabrication and installation of construction traffic control devices shall be in accordance with applicable provisions of the MUTCD. When traffic control devices are no longer required for traffic handling in the initial phase of construction requiring their use, they may be reused at various locations throughout the Project provided the device is not defaced, is structurally sound, clean, and otherwise conforms to the above requirements.

C. Traffic control devices which do not meet the requirements of this Section shall not be used. When during the life of the Project, a device ceases to meet the requirements of this Section, it shall be promptly removed and replaced with a conforming device at no additional compensation. The Engineer shall have the authority to determine the acceptability of the traffic control devices.

D. Construction Methods: Traffic control devices shall be installed at the inception of construction operations and shall be properly maintained, relocated as necessary, cleaned,

and operated during the time they are in use. They shall remain in place only as long as they are needed and shall be immediately removed thereafter. Where operations are performed in stages, only those devices that apply to the conditions present shall be left in place.

E. The location, legends, sheeting, dimensions, number of supports, and horizontal and vertical placement of warning signs, barricades, and other traffic control devices shall be as required by the MUTCD or as directed by the Engineer. During periods when not warranted, warning signs and other devices shall be removed from the work area, covered with specified material, or otherwise positioned so they do not convey their message to the traveling public. If covered, the covering material shall be exterior plywood and shall cover the entire face of the sign panel. The covering material shall be installed in such a manner that the sign panel will not be defaced. Covering material shall be maintained in a neat and workmanlike manner during its use.

F. Weeds, brush, trees, construction materials, equipment, etc., shall not be allowed to obscure any traffic control device in use.

G. If cones are used for delineation at night, each cone shall have an appropriate white reflectorized cone collar as required by the MUTCD or as directed by the Engineer.

H. Competent and properly trained flaggers, properly attired and equipped, shall be provided when directed by the Engineer or when the Contractor deems it necessary to safely handle traffic through the construction area.

I. The Contractor shall assume full responsibility for the continuous and expeditious maintenance of all construction warning signs, barricades, and other traffic control devices. Maintenance shall include repair and replacement of traffic control devices which, in the opinion of the Engineer, are damaged by traffic or other means, or deteriorated beyond effectiveness. Conditions covered under maintenance shall include, but not be limited to, replacement due to loss of reflectivity; replacement of broken supports; plumbing of leaning signs; cleaning of dirty signs, barricades, and other devices; repair of defaced sheeting and legend; and replacement of stolen or vandalized items. All items used for traffic control shall be maintained in a satisfactory condition. Failure to maintain all traffic control devices in a satisfactory condition may be cause for suspension of construction operations until proper traffic control is re-established.

J. The Contractor shall continuously review and maintain all traffic handling measures to assure that adequate provisions have been made for the safety of the public and workers.

2.02 STATIONARY CONSTRUCTION SIGNS

A. Description: The work covered by this Section consists of furnishing, erecting, relocating, maintaining, and removing stationary signs necessary for controlling traffic in accordance with the Specifications, MUTCD, or as required by local jurisdictions and/or as directed by the Engineer.

B. Materials: Reflective sheeting shall be used on all sign facing and shall meet the requirements of AASHTO M268. The reflective sheeting shall be enclosed lens (engineer's grade) sheeting and shall have a smooth, sealed outer surface which will display the same color both day and night. The reflective sheeting on each sign shall have a smooth appearance. The reflective sheeting shall be applied in a workmanlike manner so that there are no bubbles or wrinkles in the material.

1. The Contractor shall furnish a material certification in accordance with the ALDOT Standard Specifications for Highway Construction, latest edition, for all new and used reflective sheeting as required by the Engineer.

C. Construction Methods: All work shall be in accordance with requirements of Article 2.01 herein.

2.03 TYPE III BARRICADES

A. Description: The work covered by this Section consists of furnishing, erecting, maintaining, and removing Type III Barricades in accordance with the Specifications, MUTCD, or as required by local jurisdictions and/or as directed by the Engineer.

B. Construction Methods: All work shall be in accordance with requirements of Article 2.01 herein.

2.04 PORTABLE TEMPORARY TRAFFIC CONTROL DEVICES

A. Description: The work covered by this Section consists of furnishing erecting, relocating, maintaining, and removing portable temporary traffic control devices necessary for controlling traffic in accordance with the Specifications, MUTCD, or as required by local jurisdictions and/or as directed by the Engineer. Portable temporary traffic control devices shall include but not be limited to portable signs, non-metallic drums, barricades, cones, delineators, flaggers, pilot vehicles, and any other traffic control device not covered by any other Sections included in this Contract.

B. Portable Signs: Reflective sheeting shall be used on all sign facing and shall meet the requirement of AASHTO M268. The reflective sheeting shall be enclosed lens (engineer's grade) sheeting and shall have a smooth, sealed outer surface which will display the same color both day and night. The reflective sheeting on each sign shall have a smooth appearance. The reflective sheeting shall be applied in a workmanlike manner so that there are no bubbles or wrinkles in the material.

1. The Contractor shall furnish a material certification in accordance with the ALDOT Standard Specifications for Highway Construction, latest edition, for all new and used reflective sheeting as required by the Engineer.

C. Non-Metallic Drums: The drums shall be made of plastic impact resistant material. The drums shall have a two-piece, breakaway design that will maintain its integrity upon impact throughout a temperature range of –20°F to 125°F. Upon impact, the upper portion of the drum shall deform and breakaway from the base, minimizing damage to drums or vehicles. The base and ballast shall remain in position and vehicle shall easily pass over it.

1. The drums shall be designed to have two Type "A" or "C" light wells located on the top surface of the drums. The drums shall be designed with a top to completely seal the drums to prevent water from accumulating and freezing in the bottom of the drums. The base shall be designed to accommodate a sandbag of 40 lbs. to 60 lbs. A sandbag with 50 lbs. of sand shall be supplied with each drum.

2. The drums shall have an assembled minimum height of 36 inches, a minimum outside base diameter of 21 inches, and a combined minimum weight of 12 lbs.

3. The Contractor shall be required to furnish the Engineer a sample drum and its specifications for approval prior to the delivery of drums for the Project.

4. The markings on drums shall be horizontal, circumferential, orange and white stripes six to eight inches wide, covering entire outside. The entire area of orange and white shall be reflectorized with the enclosed lens (engineer's grade) sheeting, except for the corrugation area where a 2-inch non-reflectorized band will be allowed. There shall be at least two orange and two white stripes on each drum. Reflectorized material shall have a smooth, sealed outer surface which shall display the same approximate color day and night. The reflective sheeting shall meet the requirements of AASHTO M268.

D. Construction Methods: All work shall be in accordance with the requirements of Article 2.01 herein.

2.05 FLASHING ARROW PANELS

A. Description: The work covered by this Section consists of furnishing, maintaining, moving, and relocating flashing arrow panels mounted on a trailer, truck, or other mobile unit in accordance with the Specifications, MUTCD, or as required by local jurisdictions and/or as directed by the Engineer.

B. Materials: The flashing arrow panels shall meet the requirements of the MUTCD (Section 6E) for a Type A panel.

C. Construction Methods: All work shall be in accordance with the requirements of Article 2.01 herein.

D. During periods of time that traffic is shifted from its normal pattern, a mobile flashing arrow panel shall be used at locations directed by the Engineer.

PART 3 - EXECUTION

3.01 CONSTRUCTION PARKING CONTROL

A. The Contractor shall control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations.

B. The Contractor shall monitor parking of construction personnel's vehicles in existing facilities and maintain vehicular access to and through parking areas.

C. The Contractor shall prevent parking on or adjacent to access roads or in non-designated areas.

3.02 MAINTENANCE OF TRAFFIC

A. Whenever and wherever, in the Engineer's opinion, traffic is sufficiently congested or public safety is endangered, the Contractor shall furnish uniformed officers to direct traffic and to keep traffic off the highway area(s) affected by construction operations.

B. When the Contract requires the maintenance of vehicular traffic on an existing road, street, or highway during the Contractor's performance of Work that is otherwise provided for in the Contract Drawings and Specifications, the Contractor shall keep such road, street, or highway open to all traffic and shall provide such maintenance as may be required to safely accommodate traffic. The Contractor shall furnish, erect, and maintain barricades, warning signs, flagmen, and other traffic control devices in conformance with the latest edition of the MUTCD, unless otherwise specified herein. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary to ingress to and egress from abutting property or intersecting roads, streets, or highways. The Contractor shall maintain traffic in accordance with his approved Traffic Control Plan.

C. The Contractor shall make his own estimate of all labor, materials, equipment, and incidentals necessary for providing the maintenance of traffic as specified in this Section.

3.03 UNIFORMED POLICE OFFICER FOR TRAFFIC CONTROL

A. Police officers shall be placed solely by direction of the Engineer, and their usage shall be approved by the Engineer in writing in advance of the work for which the police officer will be performing traffic control.

B. Officers shall be currently employed by a local jurisdiction, be in full uniform, and have full arrest power while working.

C. Officers shall be employed by and paid by the Contractor.

D. It shall be the responsibility of the officer(s) to assist in the direction of traffic within the construction site.

3.04 FLAGMEN

A. The Contractor shall provide trained and equipped flagmen to regulate traffic when construction operations or traffic encroach on public traffic lanes.

3.05 FLASHING LIGHTS

A. The Contractor shall use flashing lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.06 HAUL ROUTES

A. The Contractor shall consult with authorities and establish public thoroughfares to be used for haul routes and site access.

B. The Contractor shall confine construction traffic to designated haul routes.

C. The Contractor shall provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

3.07 ROAD CLOSURES ON COUNTY ROADS

A. No street, road, or highway shall be closed without the permission of the appropriate municipality(-ies) and entity(-ies) having jurisdiction over the specific street, road, or highway to be closed and also the fire department having jurisdiction. Prior to closing a specific street, road, or highway, signs forewarning of the imminent closing shall be posted for a minimum of seven (7) days prior to the actual closing. The appropriate municipality(-ies) and entity(-ies) having jurisdiction over the specific street, road, or highway shall determine the information to be placed upon the signs by the Contractor. Where traffic is diverted around construction work, the Contractor shall provide all materials and perform all work for the construction and maintenance of all required temporary roadways, structures, barricades, signs, and signalization.

B. To obtain approval to close a street or road, the Contractor must proceed as follows:

1. The Contractor must obtain approval of his Traffic Control Plan from the appropriate municipality(-ies) and entity(-ies) having jurisdiction. The Traffic Control Plan must be in accordance with the MUTCD.

2. The Contractor must obtain a utility permit.

3. The Contractor must apply in writing to the appropriate municipality(-ies) and entity(-ies) having jurisdiction for approval to close the street or road on a specific date.

4. The Contractor must obtain approval from the appropriate municipality(-ies) and entity(-ies) having jurisdiction over the specific street or road to be closed before posting closure signs. Signs must be posted for seven (7) days prior to the first day of closure.

5. Emergency road closures shall be handled by the Contractor.

C. Unless otherwise approved by the appropriate municipality(-ies) and entity(-ies) having jurisdiction over a specific street or road that was closed for a pipeline or manhole replacement, Contractor shall perform temporary pavement repairs at the conclusion of each workday so the street or road that was closed is completely open to and passable by public traffic during times and days that are not included in the normal time of work as specified in Section 01015 – Prosecution and Progress.

3.08 BARRICADES AND WARNING SIGNS

A. The Contractor shall furnish, erect, and maintain all barricades and warning signs for hazards necessary to protect the public and the construction work. When used during periods of darkness, such barricades, warning signs, and hazard markings shall be suitably illuminated or reflectorized.

B. For vehicular and pedestrian traffic, the Contractor shall furnish, erect, and maintain barricades, warning signs, lights, and other traffic control devices in conformity with the latest edition of the MUTCD.

C. The Contractor shall furnish and erect all barricades and warning signs for hazards prior to commencing work which requires such erection and shall maintain the barricades and warning signs for hazards until their dismantling is directed by the Engineer.

3.09 REMOVAL

A. The Contractor shall remove equipment and devices when no longer required and shall repair damage caused by installation.

- END OF SECTION -

SECTION 01580
PROJECT IDENTIFICATION SIGNS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Quality Assurance

B. Submittals

C. Sign Material

D. Project Informational Signs

E. Installation

F. Maintenance

G. Removal

1.02 RELATED SECTIONS

A. Section 01010 – Summary of Work

B. Section 01300 – Submittals

C. Section 01560 – Temporary Environmental Controls

D. Section 01570 – Traffic Regulation

1.03 QUALITY ASSURANCE

A. All signs and structures shall be designed to withstand a wind velocity of 60 miles per hour.

B. Sign painters shall have a minimum of 3 years of experience.

C. Sign finishes shall be adequate to withstand weathering, fading, and chipping for the duration of construction.

1.04 SUBMITTALS

A. The Contractor shall submit sign layout showing content, lettering, color, foundation, structure, sizes, and grades of members.

PART 2 – PRODUCTS

2.01 SIGN MATERIAL

A. Structure and framing shall be structurally adequate.

B. Sign surfaces shall be exterior grade plywood with medium density overlay, minimum 3/4-inch thick. Standard large sizes shall be used to minimize joints.

C. Rough hardware shall be galvanized.

D. Paint and primers shall be of exterior quality, with two coats and sign background of selected color.

E. Lettering shall be exterior quality paint with contrasting colors.

2.02 PROJECT INFORMATIONAL SIGNS

A. Lettering and colors of painted informational signs shall be in accordance with Series C of Standard Alphabet for Highway Signs. Lettering shall be sized to provide legibility at a distance of 100 feet.

B. The Contractor shall provide directional signs to direct traffic into and around the site. Signs shall be relocated as required by the progress of the Work.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Contractor shall erect supports and framing on a secure foundation, rigidly braced and framed to resist wind loadings.

B. The Contractor shall install sign surface plumb and level, with butt joints.

C. The Contractor shall paint exposed surfaces of sign, supports, and framing.

3.02 MAINTENANCE

A. The Contractor shall clean and maintain signs and supports and repair deterioration and damage.

3.03 REMOVAL

A. The Contractor shall remove signs, framing, supports, and foundations at the completion of the Project and shall restore the area to original or better condition.

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SECTION 01600
MATERIALS AND EQUIPMENT

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Furnish and Install

1. Where the words "furnish", "provide", "supply", "replace", or "install" are used, whether singularly or in combination, they shall mean to furnish and install, unless specifically stated otherwise.

2. In the interest of brevity, the explicit direction "to furnish and install" has sometimes been omitted in specifying materials and/or equipment herein. Unless specifically noted otherwise, it shall be understood that all equipment and/or materials specified or shown on the Drawings shall be furnished and installed under the Contract as designated on the Drawings.

1.02 MATERIALS AND EQUIPMENT

A. All equipment, materials, or devices incorporated in this project shall be new and unused, unless indicated otherwise in the Contract Documents. Equipment and materials to be incorporated into the work shall be delivered sufficiently in advance of their installation and use to prevent delay in the execution of the work, and they shall be delivered as nearly as feasible in the order required for executing the work.

B. The Contractor shall protect all equipment and materials from deterioration and damage, including provisions for temporary storage buildings as needed and as specified in Section 01550 – Site Access and Storage. Storage of equipment and materials shall be in locations completely protected from flooding, standing water, excessive dust, falling rock, brush fire, etc. Storage areas shall be located sufficiently distant from all construction activities and the movement of construction vehicles to minimize the potential for accidental damage. Any equipment or materials of whatever kind which may have become damaged or deteriorated from any cause shall be removed and replaced by good and satisfactory items at the Contractor's expense for both labor and materials.

1.03 INSTALLATION OF MATERIALS AND EQUIPMENT

A. Materials and equipment shall be installed in accordance with the requirements of the General Conditions, Special Conditions, and the respective Specification Sections.

1.04 SUBSTITUTIONS

A. Requests for substitutions of equipment or materials shall conform to the requirements of the General Conditions, Special Conditions, and as hereinafter specified.

1. Contractor shall submit for each proposed substitution sufficient details, complete descriptive literature and performance data together with samples of the materials, where feasible, to enable the Owner and Engineer to determine if the proposed substitution is equal.

2. Contractor shall submit certified tests, where applicable, by an independent laboratory attesting that the proposed substitution is equal.

3. A list of installations where the proposed substitution is equal.

4. Requests for substitutions shall include full information concerning differences in cost, and any savings in cost resulting from such substitutions shall be passed on to the Owner.

B. Where the approval of a substitution requires revision or redesign of any part of the work, including that of other Contracts, all such revision and redesign, and all new drawings and details therefore, shall be provided by the Contractor at his own cost and expense, and shall be subject to the approval of the Owner and Engineer.

C. In the event that the Engineer is required to provide additional engineering services, then the Engineer's charges for such additional services shall be charged to the Contractor by the Owner in accordance with the requirements of the General Conditions, and the Special Conditions.

D. In all cases the Owner and Engineer shall be the judge as to whether a proposed substitution is to be approved. The Contractor shall abide by their decision when proposed substitute items are judged to be unacceptable and shall in such instances furnish the item specified or indicated. No substitute items shall be used in the work without written approval of the Owner and Engineer.

E. Contractor shall have and make no claim for an extension of time or for damages by reason of the time taken by the Engineer in considering a substitution proposed by the Contractor or by reason of the failure of the Engineer to approve a substitution proposed by the Contractor.

F. Acceptance of any proposed substitution shall in no way release the Contractor from any of the provisions of the Contract Documents.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

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SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Contractor's Responsibility for the Work

B. Closeout Procedures

C. Contract Completion

D. Contractor's Advertisement of Completion

E. Project Record Documents

F. Final Cleaning

1.02 RELATED SECTIONS

A. Section 01740 – Warranties

1.03 CONTRACTOR'S RESPONSIBILITY FOR THE WORK

A. Until Final Acceptance by the Engineer as provided for in these Specifications, the Work shall be under the charge and care of the Contractor, and he shall take every necessary precaution to prevent injury or damage to the Work or any part thereof by the action of the elements or from any other cause whatsoever, whether arising from the execution or from the non-execution of the Work. The Contractor shall rebuild, repair, restore, and make good, at his own expense, all injuries or damage to any portion of the Work occasioned by any of the causes previously named herein before acceptance.

1.04 CLOSEOUT PROCEDURES

A. The Contractor shall submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work has been completed in accordance with the Contract Documents and ready for the Engineer's review.

B. The Contractor shall provide submittals to the Engineer as required by governing or other authorities.

C. The Contractor shall submit a statement of final accounting of MBE/DBE participation for the completed project, in conformance with the Owner’s MBE/DBE Program.

D. The Contractor shall submit final Application for Payment.

1.05 CONTRACT COMPLETION

A. The Contract will be considered fulfilled, except as provided in any bond or by law, and the warranty specified in individual sections when all the Work has been completed, the final inspection made, and Final Acceptance and final payment have been made by the Owner.

B. After final inspection and upon receipt of satisfactory evidence of payment for all labor and materials used in the Work, the Engineer will notify the Owner, in writing, of his acceptance of the Work performed under the Contract and of his recommendations in respect to final payment to the Contractor.

1.06 CONTRACTOR'S ADVERTISEMENT OF COMPLETION

A. The Contractor, immediately after being notified that all other requirements of his Contract have been completed, shall give notice of said completion by an advertisement for a period of four (4) successive weeks in some newspaper of general circulation published within Jefferson County. Proof of publication of said notice shall be made by the Contractor to the Owner by affidavit of the publisher and a printed copy of the published notice.

1.07 PROJECT RECORD DOCUMENTS

A. Refer to Section 01720 – Project Record Documents

1.08 FINAL CLEANING

A. Refer to Section 31 70 00 – Final Grading and Landscaping.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1 -- GENERAL

1.01 SECTION INCLUDES

A. Maintenance of Documents

B. Marking Devices

C. Recording

D. Submittals

1.02 RELATED SECTIONS

A. Section 01300 – Submittals

B. Section 01700 – Contract Closeout

1.03 MAINTENANCE OF DOCUMENTS

A. The Contractor shall obtain from the Engineer one (1) full-size set of the Contract Drawings. These Drawings shall be kept and maintained in good condition at the project site, and a qualified representative of the Contractor shall enter upon these prints, from day-to-day, the actual "as-built" record of the construction progress. Entries and notations shall be made in a neat and legible manner, and these prints shall be delivered to the Engineer upon completion of the construction. Approval of each Application for Payment and approval for final payment will be contingent upon compliance with this provision.

B. The Contractor shall maintain a record copy of the following items at the site for the Engineer's review:

1. Drawings (modified to suit as-built conditions)

2. Specifications and schedules (with modifications noted)

3. Addenda

4. Change Orders and other documents which modify the original documents

5. Approved Shop Drawings, product data, and samples, including documentation of

all submittal transmittals

6. Records of all changes made during construction

7. Field test records

8. Manufacturers' certificates

9. Inspection certificates

C. The Contractor shall maintain documents in a clean, dry, and legible condition.

D. The Contractor shall not use record documents for construction purposes.

E. The Contractor shall make documents available at all times for inspection by the Engineer.

1.04 MARKING DEVICES

A. The Contractor shall provide a colored pencil or felt-tip marking pen for all marking.

1.05 RECORDING

A. The Contractor shall label each document "PR".

B. The Contractor shall keep record information current with construction progress.

C. The Contractor shall not permanently conceal any work until required information has been recorded.

D. Contract Drawings and Shop Drawings shall have each item legibly marked to record actual construction including the following:

1. Actual elevations

2. Actual horizontal and vertical location of piping, utilities, corners, etc., both above-ground and below-ground. Reference to building exterior lines or other permanent objects. The Contractor shall show direction of flow in pipe and elevation.

3. Field change of dimensions and detail

4. Changes made by Contract modification

5. Added details not on the original Contract

E. Each Section of the Specifications and Addenda shall be legibly marked to record the

following:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed

2. Other matters not originally specified

F. Shop Drawings shall be maintained as record documents and legibly annotated to record changes made after review.

1.06 SUBMITTALS

A. At Contract Closeout, the Contractor shall deliver Project Record Documents and Samples, including Record "As-Built" Drawings, to the Engineer.

B. Project Record Documents and Samples shall be accompanied by transmittal letter, in duplicate, containing the following:

1. Date

2. Project title and number

3. Contractor's name and address

4. Title and number of each record document

5. Certification that each document as submitted is complete and accurate

6. Signature of Contractor or authorized representative

7. Other documents as directed by the Engineer

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION (Not Used)

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SECTION 01740
WARRANTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. One Year Warranty

B. Form of Submittals

C. Preparation of Submittals

D. Time of Submittals

1.02 RELATED SECTIONS

A. Section 01700 – Contract Closeout

B. Individual Specification Sections: Warranties required for specific products of Work

1.03 ONE-YEAR WARRANTY

A. Unless specified otherwise by individual Specification Sections, the Contractor shall warrant the fitness and soundness of all Work done and materials and equipment put in place under the Contract for a period of one (1) year after the completion of the Contract, and neither the payment of the final estimate nor any provision in the Contract Documents nor partial or entire occupancy of the premises by the Owner shall constitute an acceptance of Work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall remedy all defects in the Work and pay for any damage to other work resulting therefrom which shall appear within a period of one (1) year from the date of Final Acceptance of the Work, unless a longer period is specified in individual Sections. The Owner will give notice of observed defects with reasonable promptness. The accepted date of the beginning of the one (1)-year warranty shall be the date of final estimate payment to the Contractor by the Owner.

1.04 FORM OF SUBMITTALS

A. Warranties shall be bound in commercial quality 8-1/2-inch x 11-inch, three D side ring binders with durable plastic covers.

B. Identify each binder with typed title WARRANTIES; title of project; name, address, and telephone number of Contractor; name, address, and telephone number of equipment supplier; and name of responsible company principal.

C. Table of Contents shall be neatly typed with each item identified with the number and title of the Specification Section in which the item is specified and the name of the product or Work item.

D. Each warranty shall be separated with index tab sheets keyed to the Table of Contents listing. The Contractor shall provide full information, using separate typed sheets as necessary. The Contractor shall list subcontractor, supplier, manufacturer, and name, address, and telephone number of responsible principal.

1.05 PREPARATION OF SUBMITTALS

A. The Contractor shall obtain warranties executed in duplicate by responsible subcontractors, suppliers, and manufacturers within ten (10) days after completion of the applicable item of Work. Except for items put into use with Owner's permission, the Contractor shall leave date of beginning of time of warranty until the Date of Completion is determined.

B. The Contractor shall verify that documents are in proper form, contain full information, and are notarized.

C. The Contractor shall co-execute submittals when required.

D. The Contractor shall retain warranties until time specified for submittal.

1.06 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during construction with Owner's permission, the Contractor shall submit documents within ten (10) days after acceptance.

B. The Contractor shall make other submittals within ten (10) days after date of Substantial Completion, prior to final Application for Payment.

C. For items of Work for which acceptance is delayed beyond date of Substantial Completion, the Contractor shall submit within ten (10) days after acceptance, listing the date of acceptance as the beginning of the warranty period.

D. Retainage withheld for this project will not be released until all specified warranties are received by the Owner.

PART 2 - PRODUCTS
(NOT USED)

PART 3 - EXECUTION
(NOT USED)

- END OF SECTION -

DIVISION 03

CONCRETE

SECTION 03 11 00
CONCRETE FORMWORK

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Provide materials, labor, and equipment required for the design and construction of all concrete formwork, bracing, shoring and supports in accordance with the provisions of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 – Submittals

B. Section 03 20 00 – Reinforcing Steel

C. Section 03 15 00 – Concrete Accessories

D. Section 03 30 00 – Cast-in-Place Concrete

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. 2009 International Building Code

2. ACI 318 - Building Code Requirements for Structural Concrete

3. ACI 301 - Specifications for Structural Concrete for Buildings

4. ACI 347 - Recommended Practice for Concrete Formwork

5. U.S. Product Standard for Concrete Forms, Class I, PS 1

6. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300 – Submittals.

1. Manufacturer's data on proposed form release agent

2. Manufacturer's data on proposed formwork system including form ties

1.05 QUALITY ASSURANCE

A. Concrete formwork shall be in accordance with ACI 301, ACI 318, and ACI 347.

PART 2 -- PRODUCTS

2.01 FORMS AND FALSEWORK

A. All forms shall be smooth surface forms unless otherwise specified.

B. Wood materials for concrete forms and falsework shall conform to the following requirements:

1. Lumber for bracing, shoring, or supporting forms shall be Douglas Fir or Southern Pine, construction grade or better, in conformance with U.S. Product Standard PS20. All lumber used for forms, shoring or bracing shall be new material.

2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Pine high density overlaid (HDO) plywood manufactured especially for concrete formwork and shall conform to the requirements of PS1 for Concrete Forms, Class I, and shall be edge sealed. Thickness shall be as required to support concrete at the rate it is placed, but not less than 5/8-inch thick.

C. Other form materials such as metal, fiberglass, or other acceptable material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line and grade indicated may be submitted to the Engineer for approval, but only materials that will produce a smooth form finish equal or better than the wood materials specified will be considered.

2.02 FORMWORK ACCESSORIES

A. Form ties shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The

maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 7/8-inch, and all such fasteners shall be such as to leave holes of regular shape for reaming.

B. Form ties for water-retaining structures shall have integral waterstops. Removable taper ties may be used when acceptable to the Engineer. A preformed mechanical EPDM rubber plug shall be used to seal the hole left after the removal of the taper tie. Plug shall be X-Plug by the Greenstreak Group, Inc., or approved equal. Friction fit plugs shall not be used.

C. Form release agent shall be a blend of natural and synthetic chemicals that employs a chemical reaction to provide quick, easy and clean release of concrete from forms. It shall not stain the concrete and shall leave the concrete with a paintable surface. Formulation of the form release agent shall be such that it would minimize formation of "bug holes" in cast-in-place concrete.

PART 3 -- EXECUTION

3.01 FORM DESIGN

A. Forms and falsework shall be designed for total dead load, plus all construction live load as outlined in ACI 347. Design and engineering of formwork and safety considerations during construction shall be the responsibility of the Contractor.

B. Forms shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. The maximum deflection of facing materials reflected in concrete surfaces exposed to view shall be 1/240 of the span between structural members.

C. All forms shall be designed for predetermined placing rates per hour, considering expected air temperatures and setting rates.

3.02 CONSTRUCTION

A. The type, size, quality, and strength of all materials from which forms are made shall be subject to the approval of the Engineer. No falsework or forms shall be used which are not clean and suitable. Deformed, broken or defective falsework and forms shall be removed from the work.

B. Forms shall be smooth and free from surface irregularities. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Joints between the forms shall be sealed to eliminate any irregularities. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to a practical minimum.

C. Forms shall be true to line and grade, and shall be sufficiently rigid to prevent displacement and sagging between supports. Curved forms shall be used for curved and circular structures. Straight panels joined at angles will not be acceptable for forming curved structures. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly-placed concrete. Facing material shall be supported with studs or other backing which shall prevent both visible deflection marks in the concrete and deflections beyond the tolerances specified.

D. Forms shall be mortar tight so as to prevent the loss of water, cement and fines during placing and vibrating of the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1 to 1-1/2 inch diameter polyethylene rod held in position to the underside of the wall form.

E. All vertical surfaces of concrete members shall be formed, and side forms shall be provided for all footings, slab edges and grade beams, except where placement of the concrete against the ground is called for on the Drawings. Not less than 1-inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

F. All forms shall be constructed in such a manner that they can be removed without hammering or prying against the concrete. Wood forms shall be constructed for wall openings to facilitate loosening and to counteract swelling of the forms.

G. Adequate clean-out holes shall be provided at the bottom of each lift of forms. Temporary openings shall be provided at the base of column forms and wall forms and at other points to facilitate cleaning and observation immediately before the concrete is deposited. The size, number and location of such clean-outs shall be as acceptable to the Engineer.

H. Construction joints shall not be permitted at locations other than those shown or specified, except as may be acceptable to the Engineer. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. For flush surfaces at construction joints exposed to view, the contact surface of the form sheathing over the hardened concrete in the previous placement shall be lapped by not more than 1 inch. Forms shall be held against hardened concrete to prevent offset or loss of mortar at construction joints and to maintain a true surface.

I. The formwork shall be cambered to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete and due to construction loads. Set forms and intermediate screed strips for slabs accurately to produce the designated elevations and

contours of the finished surface. Ensure that edge forms and screed strips are sufficiently strong to support vibrating screeds or roller pipe screeds if the nature of the finish specified requires the use of such equipment. When formwork is cambered, set screeds to a like camber to maintain the proper concrete thickness.

J. Positive means of adjustment (wedges or jacks) for shores and struts shall be provided and all settlement shall be taken up during concrete placing operation. Shores and struts shall be securely braced against lateral deflections. Wedges shall be fastened firmly in place after final adjustment of forms prior to concrete placement. Formwork shall be anchored to shores or other supporting surfaces or members to prevent upward or lateral movement of any part of the formwork system during concrete placement. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

K. Runways shall be provided for moving equipment with struts or legs. Runways shall be supported directly on the formwork or structural member without resting on the reinforcing steel.

3.03 TOLERANCES

A. Unless otherwise indicated in the Contract Documents, formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits listed in ACI 117.

B. Structural framing of reinforced concrete around elevators and stairways shall be accurately plumbed and located within 1/4 in. tolerance from established dimensions.

C. The Contractor shall establish and maintain in an undisturbed condition and until final completion and acceptance of the project, sufficient control points and bench marks to be used for reference purposes to check tolerances. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by Contractor's personnel and by the Engineer and shall be in sufficient number and properly installed. During concrete placement, the Contractor shall continually monitor plumb and string line form positions and immediately correct deficiencies.

D. Regardless of the tolerances specified, no portion of the building shall extend beyond the legal boundary of the building.

3.04 FORM ACCESSORIES

A. Suitable moldings shall be placed to bevel or round all exposed corners and edges of beams, columns, walls, slabs, and equipment pads. Chamfers shall be 3/4 inch unless otherwise noted.

B. Form ties shall be so constructed that the ends, or end fasteners, can be removed without causing appreciable spalling at the faces of the concrete. After ends, or end fasteners of form ties have been removed, the embedded portion of the ties shall terminate not less than 2 inches from the formed face of the concrete that is exposed to wastewater or enclosed surfaces above the wastewater, and not less than 1 inch from the formed face of all other concrete. Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar as specified in Section 03 30 00. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete member. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. No snap ties shall be broken off until the concrete is at least three days old. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste.

3.05 APPLICATION - FORM RELEASE AGENT

A. Forms for concrete surfaces that will not be subsequently waterproofed shall be coated with a form release agent. Form release agent shall be applied on formwork in accordance with manufacturer's recommendations.

3.06 INSERTS AND EMBEDDED ITEMS

A. Sleeves, pipe stubs, inserts, anchors, expansion joint material, waterstops, and other embedded items shall be positioned accurately and supported against displacement prior to concreting. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

3.07 FORM CLEANING AND REUSE

A. The inner faces of all forms shall be thoroughly cleaned prior to concreting. Forms may be reused only if in good condition and only if acceptable to the Engineer. Light sanding between uses will be required wherever necessary to obtain uniform surface texture. Unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the Engineer.

3.08 FORM REMOVAL AND SHORING

A. Forms shall not be disturbed until the concrete has attained sufficient strength. Sufficient strength shall be demonstrated by structural analysis considering proposed loads, strength of forming and shoring system, and concrete strength data. Shoring shall not be removed until the supported member has acquired sufficient strength to support its weight and the load upon it. Members subject to additional loads during construction shall be adequately shored to sustain all resulting stresses. Forms shall be removed in such manner as not to impair

safety and serviceability of the structure. All concrete to be exposed by form removal shall have sufficient strength not to be damaged thereby.

B. Provided the strength requirements specified above have been met and subject to the Engineer's approval, forms may be removed at the following minimum times. The Contractor shall assume full responsibility for the strength of all such components from which forms are removed prior to the concrete attaining its full design compressive strength. Shoring may be required at the option of the Engineer beyond these periods.

	Ambient Temperature (°F.) During Concrete Placement				
	Over 95°	70°-95°	60°-70°	50°-60°	Below 50°
Walls	5 days	2 days	2 days	3 days	Do not remove until directed by Engineer (7 days minimum)
Columns	7 days	2 days	3 days	4 days	
Beam Soffits	10 days	7 days	7 days	7 days	
Elevated Slabs	12 days	7 days	7 days	7 days	

C. When, in the opinion of the Engineer, conditions of the work or weather justify, forms may be required to remain in place for longer periods of time.

D. An accurate record shall be maintained by the Contractor of the dates of concrete placings and the exact location thereof and the dates of removal of forms. These records shall be available for inspection at all times at the site, and two copies shall be furnished the Engineer upon completion of the concrete work.

3.09 RESHORING

A. When reshoring is permitted or required the operations shall be planned in advance and subjected to approval by the Engineer.

B. Reshores shall be placed after stripping operations are complete but in no case later than the end of the working day on which stripping occurs.

C. Reshoring for the purpose of early form removal shall be performed so that at no time will large areas of new construction be required to support their own weight. While reshoring is under way, no construction or live loads shall be permitted on the new construction. Reshores shall be tightened to carry their required loads but they shall not be overtightened so that the new construction is overstressed. Reshores shall remain in place until the concrete has reached its specified 28-day strength, unless otherwise specified.

D. For floors supporting shores under newly placed concrete, the original supporting shores shall remain in place or reshores shall be placed. The shoring or reshoring system shall have a capacity sufficient to resist the anticipated loads and in all cases shall have a capacity equal

to at least one-half of the capacity of the shoring system above. Reshores shall be located directly under a reshore position above unless other locations are permitted.

E. In multi-story buildings, reshoring shall extend over a sufficient number of stories to distribute the weight of newly placed concrete, forms, and construction live loads so the design superimposed loads of the floors supporting shores are not exceeded.

- END OF SECTION -

SECTION 03 15 00
CONCRETE ACCESSORIES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Furnish all materials, labor and equipment required to provide all concrete accessories including waterstops, expansion joint material, joint sealants, expansion joint seals, contraction joint inserts, and epoxy bonding agent.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 – Submittals

B. Section 03 11 00 – Concrete Formwork

C. Section 03 30 00 – Cast-in-Place Concrete

D. Section 07 92 00 – Joint Fillers, Sealants, and Caulking

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1.	ASTM C881	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
2.	ASTM D412	Standard Tests for Rubber Properties in Tension
3.	ASTM D471	Standard Test Method for Rubber Properties
4.	ASTM D624	Standard Test method for Rubber Property - Tear Resistance
5.	ASTM D638	Standard Test Method for Tensile Properties of Plastics
6.	ASTM D1171	Standard Test Method for Ozone Resistance at 500 pphm
7.	ASTM D1751	Standard Specifications for Preformed Expansion Joint fillers for Concrete Paving and Structural Construction (nonextruding and resilient bituminous types)

8. ASTM D1752 Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300 – Submittals.

1. Manufacturer's literature on all products specified herein including material certifications

2. Proposed system for supporting PVC waterstops in position during concrete placement

3. Samples of products if requested by the Engineer

PART 2 -- PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) WATERSTOPS

A. PVC waterstops for construction joints shall be flat ribbed type, 6 inches wide with a minimum thickness at any point of 3/8 inch.

B. Waterstops for expansion joints shall be ribbed with a center bulb. They shall be 9 inches wide with a minimum thickness at any point of 3/8 inch unless shown or specified otherwise. The center bulb shall have a minimum outside diameter of 1 inch and a minimum inside diameter of 1/2 inch.

C. The waterstops shall be manufactured from virgin polyvinyl chloride plastic compound and shall not contain any scrap or reclaimed material or pigment whatsoever. The properties of the polyvinyl chloride compound used, as well as the physical properties of the waterstops, shall exceed the requirements of the U.S. Army Corps. of Engineers' Specification CRD-C572. The waterstop material shall have an off-white, milky color.

D. The required minimum physical characteristics for this material are:

1. Tensile Strength: 1,750 psi (ASTM D638)

2. Ultimate Elongation: Not less than 280% (ASTM D638)

E. No reclaimed PVC shall be used for the manufacturing of the waterstops. The Contractor shall furnish certification that the proposed waterstops meet the above requirements.

F. PVC waterstops shall be as manufactured by BoMetals, Inc., DuraJoint Concrete Accessories, or Sika Greenstreak.

G. All waterstop intersections, both vertical and horizontal, shall be made from factory fabricated corners and transitions. Only straight butt joint splices shall be made in field.

2.02 RETROFIT WATERSTOPS

A. Retrofit waterstops shall be used where specifically shown on Drawings for sealing joints between existing concrete construction and new construction.

B. Retrofit waterstops shall be PVC waterstops fabricated from material as described in Article 2.01 of this Specification.

C. Retrofit waterstop shall be attached to existing concrete surface as shown on Drawings.

D. Use of split waterstop in lieu of specially fabricated retrofit waterstop will not be acceptable.

E. Retrofit waterstop manufacturer must provide a complete system including all waterstop, stainless steel anchoring hardware, and epoxy for installation.

F. For construction joints, retrofit waterstop shall be style number 609 by Sika Greenstreak, RF-638 by BoMetals, Inc., or Type 18 kit by DuraJoint Concrete Accessories. For expansion joints, retrofit waterstop shall be style number 667 by Sika Greenstreak or Type 18-9 kit by DuraJoint Concrete Accessories.

2.03 CHEMICAL RESISTANT WATERSTOPS

A. Where specifically noted on Contract Drawings, chemical resistant waterstops shall be used instead of PVC waterstops.

B. Chemical resistant waterstops for construction joints shall be ribbed with a center bulb. They shall be 6 inches wide with a minimum thickness at any point of 3/16 inches.

C. Chemical resistant waterstops for expansion joints shall be ribbed tear web. They shall be 9 inches wide with a tear web designed to accommodate 1 inch of free movement minimum.

D. Chemical resistant retrofit waterstop shall be a minimum of 2-1/2 inches wide along the ribbed side and a minimum 5 inches wide along the side attached to the existing concrete surface. Retrofit waterstop shall include a centerbulb and shall have a minimum thickness of 3/16 inch. Retrofit waterstop manufacturer shall provide a complete system including waterstop, stainless steel anchoring hardware, and epoxy for installation.

E. Chemical resistant waterstops shall be manufactured from a fully crosslinked thermoplastic vulcanizate rubber.

F. Waterstops shall be TPE-R by BoMetals, Inc., Earth Shield TPV/TPE-R by JP Specialties, Inc., Westec TPE-R by Westec Barrier Technologies, or TPE-R by DuraJoint Concrete Accessories.

2.04 HYPALON RUBBER WATERSTOPS

A. Hypalon rubber waterstops shall be Sikadur Combiflex by Sika Corporation or approved equal. Minimum width of waterstop material shall be 12 inches unless shown otherwise on Contract Drawings.

2.05 EXPANDING RUBBER WATERSTOP

A. Expanding rubber shall be designed to expand under hydrostatic conditions. Waterstops shall be Adeka Ultra Seal MC-2010M by Adeka Ultra Seal/OCM, Inc. or Hydrotite CJ-1020-2K by Sika Greenstreak for concrete thickness greater than 9 inches. For thicknesses less than 9 inches, Adeka Ultra Seal KBA-1510FF or Hydrotite CJ-1020-2K shall be used.

B. Waterstop shall be a chemically modified natural rubber product with a hydrophilic agent.

C. Waterstop has a stainless steel mesh or coextrusion of non-hydrophilic rubber to direct expansion in the thickness direction and restrict the expansion in the longitudinal direction.

2.06 WATERSTOP ADHESIVE

A. Adhesive between waterstops and existing concrete shall be 20+F Contact Cement by Miracle Adhesives Corporation, Neoprene Adhesive 77-198 by JGF Adhesives, Sikadur 31 Hi-Mod Gel by Sika Corporation, or DP-605 NS Urethane Adhesive by 3M Adhesive Systems.

2.07 JOINT SEALANTS

A. Joint sealants shall comply with Section 07 92 00 – Joint Fillers, Sealants, and Caulking.

2.08 EXPANSION JOINT MATERIAL

A. Preformed expansion joint material shall be non-extruding and shall be of the following types:

1. Type I - Sponge rubber, conforming to ASTM D1752, Type I

2. Type II - Cork, conforming to ASTM D1752, Type II

3. Type III - Self-expanding cork, conforming to ASTM D1752, Type III

4. Type IV - Bituminous fiber, conforming to ASTM D1751

2.09 EXPANSION JOINT SEAL

A. Expansion Joint Seal System shall consist of a preformed neoprene profile, installed using the same dimensions as the joint gap, bonded with a two-component epoxy adhesive and pressurized during the adhesive cure time.

B. The expansion joint system shall be Hydrozo/Jeene Structural Sealing joint system by Hydrozo/Jeene, Inc. or equal.

2.10 CONTRACTION JOINT INSERTS

A. Contraction joint inserts shall be ZipCap Control Joint former by Greenstreak Plastic Products.

2.11 EPOXY BONDING AGENT

A. Epoxy bonding agent shall conform to ASTM C881 and shall be Sikadur 32 Hi-Mod by Sika Corporation, Euco #452 Epoxy System by Euclid Chemical Company, or MasterInject 1500 by BASF Master Builder Solutions.

2.12 EPOXY RESIN BINDER

A. Epoxy resin binder shall conform to the requirements of ASTM C881, Type III, Grade 3, Class B and C for epoxy resin binder and shall be Sikadur 23, Low-Mod-Gel by the Sika Corporation, Flexocrete Gel by DuraJoint Concrete Accessories, Euco #352 Gel by Euclid Chemical Company, or MasterEmaco ADH 327 or 327 RS by BASF Master Builder Solutions.

PART 3 -- EXECUTION

3.01 PVC AND CHEMICAL RESISTANT WATERSTOPS

A. PVC and chemical resistant waterstops shall be provided in all construction and expansion joints in water bearing structures and at other such locations as required by the Drawings.

B. Waterstops shall be carefully positioned so that they are embedded to an equal depth in concrete on both sides of the joint. They shall be kept free from oil, grease, mortar or other foreign matter. To ensure proper placement, all waterstops shall be secured in correct position at 12 inches on center along the length of the waterstop on each side, prior to placing concrete. Such method of support shall be submitted to the Engineer for review and approval. Grommets or small pre-punched holes as close to the edges as possible will be acceptable for securing waterstops.

C. Splices in PVC waterstops and chemical resistant waterstops shall be made with a thermostatically controlled heating element. Only straight butt joint splices will be allowed in the field. Factory fabricated corners and transitions shall be used at all intersections. Splices shall be made in strict accordance with the manufacturer's recommended instructions and procedures. At least three satisfactory sample splices shall be made on the site. The Engineer may require tests on these splices by an approved laboratory. The splices shall exhibit not less than 80 percent of the strength of the unspliced material.

D. All splices in waterstops will be subject to rigid review for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, discoloration, charring, and other defects which would reduce the potential resistance of the material to water pressure at any point. All defective joints shall be replaced with material which will pass said review and all faulty material shall be removed from the site and disposed of by the Contractor at no additional cost to the Owner.

E. Retrofit waterstops shall be installed as shown on Contract Drawings using approved waterstop adhesive and Type 316 stainless steel batten bars and expansion anchors.

F. Waterstop installation and splicing defects which are unacceptable include, but are not limited to the following:

1. Tensile strength not less than 80 percent of parent material

2. Overlapped (not spliced) waterstop

3. Misalignment of waterstop geometry at any point greater than 1/16 inch

4. Visible porosity or charred or burnt material in weld area

5. Visible signs of splice separation when splice (24 hours or greater) is bent by hand at sharp angle

3.02 HYPALON RUBBER AND EXPANDING RUBBER WATERSTOPS

A. Waterstops shall be installed only where shown on the Drawings.

B. Waterstops shall be installed in strict accordance with manufacturer's recommendations.

3.03 WATERSTOP ADHESIVE

A. Adhesive shall be applied to both contact surfaces in strict accordance with manufacturer's recommendations.

B. Adhesive shall be used where waterstops are attached to existing concrete surfaces.

3.04 INSTALLATION OF EXPANSION JOINT MATERIAL AND SEALANTS

A. Type I, II, or III shall be used in all expansion joints in structures and concrete pavements unless specifically shown otherwise on the Drawings. Type IV shall be used in sidewalk and curbing and other locations specifically shown on the Drawings.

B. All expansion joints exposed in the finish work, exterior and interior, shall be sealed with the specified joint sealant. Expansion joint material and sealants shall be installed in accordance with manufacturer's recommended procedures and as shown on the Drawings.

C. Expansion joint material that will be exposed after removal of forms shall be cut and trimmed to ensure a neat appearance and shall completely fill the joint except for the space required for the sealant. The material shall be held securely in place and no concrete shall be allowed to enter the joint or the space for the sealant and destroy the proper functions of the joint.

D. A bond breaker shall be used between expansion joint material and sealant. The joint shall be thoroughly clean and free from dirt and debris before the primer and the sealant are applied. Where the finished joint will be visible, masking of the adjoining surfaces shall be carried out to avoid their discoloration. The sealant shall be neatly tooled into place and its finished surfaces shall present a clean and even appearance.

E. Type 1 joint sealant shall be used in all expansion and contraction joints in concrete, except where Type 7 or Type 8 is required as follows, and wherever else specified or shown on the Drawings. It shall be furnished in pour grade or gun grade depending on installation requirements. Primers shall be used as required by the manufacturer. The sealant shall be furnished in colors as directed by the Engineer.

F. Type 8 joint sealant shall be used in all concrete pavements and floors subject to heavy traffic and wherever else specified or shown on the Drawings.

G. Type 7 joint sealant shall be used for all joints in chlorine contact tanks and wherever specified or shown on the Drawings.

3.05 EXPANSION JOINT SEAL

A. The expansion joint seal system shall be installed as shown on the Drawings in strict accordance with the manufacturer's recommendations.

3.06 CONTRACTION JOINT INSERTS

A. For contraction joints in slabs, inserts shall be floated in fresh concrete during finishing.

B. For contraction joints in walls, inserts shall be secured in place prior to casting wall.

C. Inserts shall be installed true to line at the locations of all contraction joints as shown on the Drawings.

D. Inserts shall extend into concrete sufficient depth as indicated on the Drawings or specified in Section 03290 – Joints in Concrete.

E. Inserts shall not be removed from concrete until concrete has cured sufficiently to prevent chipping or spalling of joint edges due to inadequate concrete strength.

3.07 EPOXY BONDING AGENT

A. The Contractor shall use an epoxy bonding agent for bonding fresh concrete to existing concrete as shown on the Drawings.

B. Bonding surface shall be clean, sound and free of all dust, laitance, grease, form release agents, curing compounds, and any other foreign particles.

C. Application of bonding agent shall be in strict accordance with manufacturer's recommendations.

D. Fresh concrete shall not be placed against existing concrete if epoxy bonding agent has lost its tackiness.

3.08 EPOXY RESIN BINDER

A. Epoxy resin binder shall be used to seal all existing rebar cut and burned off during demolition operations. Exposed rebar shall be burned back 1/2-inch minimum into existing concrete and the resulting void filled with epoxy resin binder.

- END OF SECTION -

SECTION 03 20 00
REINFORCING STEEL

PART 1 -- GENERAL

1.01 THE REQUIREMENTS

A. Provide all concrete reinforcing including all cutting, bending, fastening and any special work necessary to hold the reinforcing steel in place and protect it from injury and corrosion in accordance with the requirements of this section.

B. Provide deformed reinforcing bars to be grouted into reinforced concrete masonry walls.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 11 00 – Concrete Formwork

B. Section 03 15 00 – Concrete Accessories

B. Section 03 30 00 – Cast-in-Place Concrete

C. Section 03 40 00 – Precast Concrete

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. 2009 International Building Code

2. CRSI Concrete Reinforcing Institute Manual of Standard Practice

3. ACI SP66 ACI Detailing Manual

4. ACI 315 Details and Detailing of Concrete Reinforcing

5. ACI 318 Building Code Requirements for Structural Concrete

6. WRI Manual of Standard Practice for Welded Wire Fabric

7. ASTM A615 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcing

8. ASTM A1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300 – Submittals.

1. Detailed placing and shop fabricating drawings, prepared in accordance with ACI 315 and ACI Detailing Manual - (SP66), shall be furnished for all concrete reinforcing. These drawings shall be made to such a scale as to clearly show joint locations, openings, and the arrangement, spacing and splicing of the bars.

2. Mill test certificates - 3 copies of each

3. Description of the reinforcing steel manufacturer's marking pattern

4. Requests to relocate any bars that cause interferences or that cause placing tolerances to be violated

5. Proposed supports for each type of reinforcing

6. Request to use splices not shown on the Drawings

7. Request to use mechanical couplers along with manufacturer's literature on mechanical couplers with instructions for installation and certified test reports on the couplers' capacity

8. Request for placement of column dowels without the use of templates

9. Request and procedure to field bend or straighten partially embedded reinforcing

10. Certification that all installers of dowel adhesive are certified as Adhesive Anchor Installers in accordance with the ACI-CRSI Anchor Installer Certification Program.

1.05 QUALITY ASSURANCE

A. If requested by the Engineer, the Contractor shall provide samples from each load of reinforcing steel delivered in a quantity adequate for testing. Costs of initial tests will be paid by the Owner. Costs of additional tests due to material failing initial tests shall be paid by the Contractor.

B. Installer Qualifications for Drilled-In Rebar: Drilled-in rebar shall be installed by an Installer with at least three years of experience performing similar installations. Installer shall be certified as an Adhesive Anchor Installer in accordance with ACI-CRSI Adhesive Anchor Installation Certification Program.

C. Installer Training: Conduct a thorough training with the manufacturer or the manufacturer's representative for the Installer on the project. Training shall consist of a review of the complete installation process for drilled-in anchors to include, but not be limited to, the following:

1. Hole drilling procedure

2. Hole preparation and cleaning technique

3. Adhesive injection technique and dispenser training/maintenance

4. Rebar doweling preparation and installation

5. Proof loading/torquing

PART 2 -- PRODUCTS

2.01 REINFORCING STEEL

A. Bar reinforcing shall conform to the requirements of ASTM A615 for Grade 60 Billet Steel reinforcing. All reinforcing steel shall be from domestic mills and shall have the manufacturer's mill marking rolled into the bar which shall indicate the producer, size, type and grade. All reinforcing bars shall be deformed bars. Smooth reinforcing bars shall not be used unless specifically called for on Drawings.

B. Welded wire fabric reinforcing shall conform to the requirements of ASTM A1064 and the details shown on the Drawings.

C. A certified copy of the mill test on each load of reinforcing steel delivered showing physical and chemical analysis shall be provided, prior to shipment. The Engineer reserves the right to require the Contractor to obtain separate test results from an independent testing laboratory in the event of any questionable steel. When such tests are necessary because of failure to comply with this Specification, such as improper identification, the cost of such tests shall be borne by the Contractor.

D. Field welding of reinforcing steel will not be allowed.

E. Use of coiled reinforcing steel will not be allowed.

2.02 ACCESSORIES

A. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers and other devices to position reinforcing during concrete placement. Slab bolsters shall have gray plastic-coated legs.

B. Concrete blocks (dobies), used to support and position bottom reinforcing steel, shall have the same or higher compressive strength as specified for the concrete in which it is located.

2.03 MECHANICAL COUPLERS

A. Mechanical couplers shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcing bars being spliced at each splice. The reinforcing steel and coupler used shall be compatible for obtaining the required strength of the connection.

B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied.

C. Hot-forged sleeve type couplers shall not be used. Acceptable mechanical couplers are Dayton Superior Dowel Bar Splicer System by Dayton Superior, Dayton, Ohio. Mechanical couplers shall only be used where shown on the Drawings or where specifically approved by the Engineer.

2.04 DOWEL ADHESIVE SYSTEM

A. Where shown on the Drawings, reinforcing bars anchored into hardened concrete with a dowel adhesive system shall use a two-component adhesive mix which shall be injected with a static mixing nozzle following manufacturer's instructions. All holes shall be drilled with a carbide bit unless otherwise recommended by the manufacturer. If coring holes is allowed by the manufacturer and approved by the Engineer, cored holes shall be roughened in accordance with manufacturer requirements. Thoroughly clean drill holes of all debris and drill dust with compressed air followed by a wire brush prior to installation of adhesive and reinforcing bar. Degree of hole dampness shall be in strict accordance with manufacturer recommendations. Where depth of hole exceeds the length of the static mixing nozzle, a plastic extension hose shall be used to ensure proper adhesive injection from the back of the hole. Injection of adhesive into the hole shall utilize a piston plug to minimize the formation of air pockets. The embedment depth of the bar shall be per manufacturer's recommendations, so as to provide a minimum allowable bond strength that is equal to 125 percent of the yield strength of the bar, unless noted otherwise on the Drawings. The adhesive system shall be Epcon System G5 as manufactured by ITW Redhead, HIT-HY 200 Injection Adhesive Anchor System as manufactured by Hilti, Inc. SET-XP as manufactured by Simpson Strong-Tie Co. or PE-1000+"by Powers Fasteners. Engineer's approval is required for use of this system in locations other than those shown on the Drawings. **Fast-set epoxy formulations shall not be acceptable. No or equal products will be considered, unless pre-qualified and approved by Engineer and Owner.**

B. Where identified on the Contract Drawings or for installation of concrete where anchorage failure could present a life-threatening hazard, the adhesive system shall be IBC compliant for use in both cracked and uncracked concrete in all Seismic Design Categories, must comply with the latest revision of ICC-ES Acceptance Criteria AC308, and shall have a valid ICC-ES report in accordance with the applicable building code. The adhesive system shall

be HIT-HY 200 Injection Adhesive Anchoring System as manufactured by Hilti, Inc. PE-1000 SD by Powers Fasteners, SET-XP by Simpson Strong-Tie Co. or Epcon System G5 as manufactured by ITW Redhead. Installation of adhesive system shall be in accordance with manufacturer's recommendations and as required in Article 2.04, Paragraph A herein. **Alternate adhesive system shall not be acceptable.**

C. All individuals installing dowel adhesive system shall be certified as an Adhesive Anchor Installer in accordance with the ACI-CRSI Anchor Installation Certification Program.

PART 3 -- EXECUTION

3.01 TEMPERATURE REINFORCING

A. Unless otherwise shown on the Drawings or in the absence of the concrete reinforcing being shown, the minimum cross sectional area of horizontal and vertical concrete reinforcing in walls shall be 0.0033 times the gross concrete area and the minimum cross sectional area of reinforcing perpendicular to the principal reinforcing in slabs shall be 0.0020 times the gross concrete area. Temperature reinforcing shall not be spaced further apart than five times the slab or wall thickness, nor more than 18 inches.

3.02 FABRICATION

A. Reinforcing steel shall be accurately formed to the dimensions and shapes shown on the Drawings and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Drawings.

B. The Contractor shall fabricate reinforcing bars for structures in accordance with the bending diagrams, placing lists and placing Drawings.

C. No fabrication shall commence until approval of Shop Drawings has been obtained. All reinforcing bars shall be shop fabricated unless approved by the Engineer to be bent in the field. Reinforcing bars shall not be straightened or rebent in a manner that will injure the material. Heating of bars will not be permitted.

D. Welded wire fabric with longitudinal wire of W9.5 size or smaller shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches. Welded wire fabric with longitudinal wires larger than W9.5 size shall be furnished in flat sheets only.

3.03 DELIVERY, STORAGE, AND HANDLING

A. All reinforcing shall be neatly bundled and tagged for placement when delivered to the job site. Bundles shall be properly identified for coordination with mill test reports.

B. Reinforcing steel shall be stored above ground on platforms or other supports and shall be protected from the weather at all times by suitable covering. It shall be stored in an orderly manner and plainly marked to facilitate identification.

C. Reinforcing steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.

D. The surfaces of all reinforcing steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcing shall be reinspected and if necessary recleaned.

3.04 PLACING

A. Reinforcing steel shall be accurately positioned as shown on the Drawings and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcing steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcing steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used in sufficient numbers to support the reinforcing bars without settlement. In no case shall concrete block supports be continuous.

B. The portions of all accessories in contact with the formwork shall be made of plastic or steel coated with a 1/8 inch minimum thickness of plastic which extends at least 1/2 inch from the concrete surface. Plastic shall be gray in color.

C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

D. Reinforcing bars additional to those shown on the Drawings, which may be found necessary or desirable by the Contractor for the purpose of securing reinforcing in position, shall be provided by the Contractor at no additional cost to the Owner.

E. Reinforcing placing, spacing, and protection tolerances shall be within the limits specified in ACI 318 except where in conflict with the Building Code, unless otherwise specified.

F. Reinforcing bars may be moved within one bar diameter as necessary to avoid interference with other concrete reinforcing, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed placing tolerances, the resulting arrangement of bars shall be as acceptable to the Engineer.

G. Welded wire fabric shall be supported on slab bolsters spaced not less than 30 inches on centers, extending continuously across the entire width of the reinforcing mat and supporting the reinforcing mat in the plane shown on the Drawings.

H. Reinforcing shall not be straightened or rebent unless specifically shown on the Drawings or authorized in writing by the Engineer. Bars with kinks or bends not shown on the Drawings shall not be used. Coiled reinforcement shall not be used.

I. Dowel Adhesive System shall be installed in strict conformance with the manufacturer's recommendations and as required in Article 2.04, Paragraph A herein. A representative of the manufacturer must be on site when required by the Engineer. Testing of adhesive dowels shall be as indicated as follows, and if the dowels are required to have a hook at the end to be embedded in the new work, an approved mechanical coupler shall be provided at a convenient distance from the face of existing concrete to facilitate the testing.

J. Adhesive Dowel Testing

1. At all locations where adhesive dowel testing is shown on the Drawings, at least 25 percent of all adhesive dowels installed shall be tested to the value indicated on the Drawings, with a minimum of one tested dowel per group. If no test value is indicated on the Drawings but the installed dowel is under direct tension, the Contractor shall notify the Engineer to verify whether anchor load testing is required.

2. Contractor shall submit a plan and schedule indicating locations of dowels to be tested, load test values, and proposed dowel testing procedure (including a diagram of the testing equipment proposed for use) to the Engineer for review prior to conducting any testing. The testing equipment shall have a minimum of three support points and shall be of sufficient size to locate the edge of supports no closer than two times the anchor embedment depth from the center of the anchor.

3. Where Contract Documents indicate adhesive dowel design to be the Contractor's responsibility, the Contractor shall submit a plan and schedule indicating locations of dowels to be tested and load test values, sealed by a Professional Engineer currently registered in the State of Alabama. The Contractor's engineer shall also submit documentation indicating that the Contractor's testing procedures have been reviewed and the proposed procedures are acceptable.

4. Adhesive Dowel shall have no visible indications of displacement or damage during or after the proof test. Concrete cracking in the vicinity of the dowel after loading shall be considered a failure. Dowels exhibiting damage shall be removed and replaced. If more than 5 percent of tested dowels fail, then 100 percent of dowels shall be proof tested.

3.05 SPLICING

A. Reinforcing bar splices shall only be used at locations shown on the Drawings. When it is necessary to splice reinforcing at points other than where shown, the splice shall be as acceptable to the Engineer.

B. The length of lap for reinforcing bars, unless otherwise shown on the Drawings, shall be in accordance with ACI 318 for a class B splice.

C. Laps of welded wire fabric shall be in accordance with ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

D. Mechanical splices shall be used only where shown on the Drawings or when approved by the Engineer.

E. Couplers which are located at a joint face shall be a type which can be set either flush or recessed from the face as shown on the Drawings. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. After the concrete is placed, couplers intended for future connections shall be plugged and sealed to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged with plastic plugs which have an O-ring seal.

3.06 INSPECTION

A. The Contractor shall advise the Engineer of his intentions to place concrete and shall allow him adequate time to inspect all reinforcing steel before concrete is placed.

B. The Contractor shall advise the Engineer of his intentions to place grout in masonry walls and shall allow him adequate time to inspect all reinforcing steel before grout is placed.

3.07 CUTTING OF EMBEDDED REBAR

A. The Contractor shall not cut embedded rebar cast into structural concrete without prior approval of the Engineer.

- END OF SECTION -

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete mix products including cementitious materials, aggregate, admixtures, mix design requirements, and concrete placing requirements.

1.02 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. Alabama Department of Transportation (ALDOT):
   a. Standard Specifications for Highway Construction (Standard Specification).
2. American Concrete Institute (ACI):
   a. 117, Specification for Tolerances for Concrete Construction and Materials.
   b. 301, Specifications for Structural Concrete.
   c. 305.1, Specification for Hot Weather Concreting.
   d. 306.1, Standard Specification for Cold Weather Concreting.
3. ASTM International (ASTM):
   a. C31/C31M, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   b. C33/C33M, Standard Specification for Concrete Aggregates.
   c. C39/C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   d. C94/C94M, Standard Specification for Ready-Mixed Concrete.
   e. C143/C143M, Standard Test Method for Slump of Hydraulic-Cement Concrete.
   f. C150/C150M, Standard Specification for Portland Cement.
   g. C231/C231M, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   h. C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.
4. National Ready Mixed Concrete Association (NRMCA).

1.03 DEFINITIONS

A. Cold Weather: When ambient temperature is below 40 degrees F or is approaching 40 degrees F and falling.

B. Defective Area: Surface defects that include honeycomb, rock pockets, indentations, and surface voids greater than 3/16-inch deep, surface voids greater than 3/4 inch in diameter, cracks in liquid containment structures and below grade habitable spaces that are 0.005-inch wide and wider, and cracks in other structures that are 0.010-inch wide and wider, spalls, chips, embedded debris, sand streaks, mortar leakage from form joints, deviations in formed surface that exceed specified tolerances and include but are not limited to fins, form pop-outs, and other projections. At exposed concrete, defective areas also include texture irregularities, stains, and other color variations that cannot be removed by cleaning.

C. Exposed Concrete: Concrete surface that can be seen inside or outside of structure regardless of whether concrete is above water, dry at all times, or can be seen when structure is drained.

D. Hot Weather: As defined in ACI 305.1.

E. New Concrete: Less than 60 days old.

PART 2 PRODUCTS

2.01 GENERAL

A. Class A Concrete shall be formed, reinforced concrete having a 28 day minimum compressive strength of 4,000 psi.

1. Class A concrete shall be cast-in-place in forms for foundations, pipe collars, footings, piers, headwalls, wet wells, manholes, junction boxes, and similar structures.
2. Mix design shall be “Concrete Class- Type A-1c” in accordance with Section 206 of the ALDOT, Standard Specifications.
3. All structures designed to be water bearing shall also incorporate a waterproofing admixture into concrete mix. The admixture shall conform to ASTM C 494, Type D or S. The admixture shall be of the crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete. The admixture shall cause the concrete to become sealed against penetrations of liquids from any direction and shall protect the concrete from deterioration due to harsh environmental conditions. The admixture shall be capable of sealing hairline cracks and resisting extreme hydrostatic pressure. Acceptable products are “Xypex Admix C-500 NF” by Xypex Chemical Corporation, “MasterLife® 300D” by BASF Corporation, and “Krystol Internal Membrane (KIM)” by Kryton International Inc. Submit certified letter from manufacturer of crystalline waterproofing admixture stating required dosage rate for job specific concrete mix.

B. Class B Concrete shall be non-formed, non-reinforced concrete having a 28-day minimum compressive strength of 3,000 psi.

1. Class B concrete shall be used for pipe protection, encasement, anchors, massive sections, and similar structures.
2. Mix design shall be “Concrete Class- Type A-1a” in accordance with Section 206 of the ALDOT, Standard Specifications.

C. Class C shall be non-formed non-reinforced cement mortar flowable fill having a 28 day minimum compressive strength of 1,000 psi.

1. Class C flowable fill shall be used for trench bottom stabilization, backfill around pipe and above pipe.
2. Mix design shall be “Mix 4” in accordance with Section 260 of the ALDOT, Standard Specifications.

D. Other classes, types or design for cast-in-place concrete may be approved by the ESD as circumstances require.

2.02 MATERIALS

A. Cementitious Materials:

1. Cement:
   a. Portland Cement: Unless otherwise specified, conform to requirements of ASTM C150/C150M.
   b. Furnish from one source.
2. When used for construction of manholes pump stations and locations where in contact with wastewater, the Tri Calcium Aluminate content must be less than 5.5 percent.

B. Aggregates: Furnish from one source for each aggregate type used in a mix design.

1. Normal-Weight Aggregates:
   a. In accordance with ASTM C33/C33M, except as modified herein.
2. Fine Aggregates:
   a. Natural sand consisting of clean, hard, durable, uncoated grains.
   b. ASTM C33/C33M.
3. Coarse Aggregate:
   a. Uncoated particles of sound, durable rock of uniform quality, without any excess of flat, elongated or laminated pieces.
   b. No surface, yellow or soft stone shall be permitted.
   c. Specific gravity of the stone shall be not less than 2.55.

C. Water: Mixing water for concrete shall be potable water.

2.03 ANCILLARY MATERIALS

A. Reinforcing Material for Cast-In-Place Concrete:

1. Reinforcing bars shall conform to the requirements of ASTM A614.
2. Reinforcing bars shall be grade 60 deformed bars, or as specified by Design Engineer.
3. Welded wire fabric or cold-drawn wire for concrete reinforcement shall conform to the requirements of ASTM A185 or ASTM A82, respectively.

B. Grout: Grout shall consist of mixture of water and cement or water and one-part cement to two parts mortar sand, by volume. The water may be adjusted to produce a mixture suitable for field conditions.

C. Water Stop Grout/Hydraulic Cement: Shall be Bonsal Instant Hydraulic Cement, or BASF MasterSeal 590. No other products will be allowed.

2.04 CONCRETE MIXING

A. General: In accordance with ACI 301, except as modified herein.

B. Truck Mixers:

1. For every truck, test slump of samples taken per ASTM C94/C94M, paragraph 12.5.1.
2. Where specified slump is more than 4 inches, and if slump tests differ by more than 2 inches, discontinue use of truck mixer, unless causing condition is corrected and satisfactory performance is verified by additional slump tests.

PART 3 EXECUTION

3.01 PLACING CONCRETE

A. Preparation: Meet requirements ACI 301, except as modified herein.

B. Placement into Formwork:

1. Reinforcement: Secure in position before placing concrete.
2. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 1.5 feet deep, except for slabs which shall be placed full depth. Place and consolidate successive layers prior to initial set of first layer to prevent cold joints.
3. Use placement devices, for example chutes, pouring spouts, and pumps as required to prevent segregation.

4. Vertical Free Fall Drop to Final Placement:
    a. Forms 8 Inches or Less Wide: 5 feet.
    b. Forms Wider than 8 Inches: 8 feet, except as specified.
5. For placements where drops are greater than specified, use placement device such that free fall below placement device conforms to required value.
    a. Limit free fall to prevent segregation caused by aggregates hitting steel reinforcement.
6. Do not use aluminum conveying devices.
7. Provide sufficient illumination in the interior of forms so concrete deposition is visible, permitting confirmation of consolidation quality.
8. Joints in Footings and Slabs:
    a. Ensure space beneath plastic waterstop completely fills with concrete.
    b. During concrete placement, make visual inspection of entire waterstop area.
    c. Limit concrete placement to elevation of waterstop in first pass, vibrate concrete under waterstop, lift waterstop to confirm full consolidation without voids, and place remaining concrete to full height of slab.
    d. Apply procedure to full length of waterstop.
9. Trowel and round off top exposed edges of walls with 1/4-inch radius steel edging tool.
10. Cure concrete in accordance with ACI 308.

C. Conveyor Belts and Chutes:

1. Design and arrange ends of chutes, hopper gates, and other points of concrete discharge throughout conveying, hoisting, and placing system for concrete to pass without becoming segregated.
2. Do not use chutes longer than 50 feet.
3. Minimum Slopes of Chutes: Angled to allow concrete to readily flow without segregation.
4. Conveyor Belts:
    a. Wipe clean with device that does not allow mortar to adhere to belt.
    b. Cover conveyor belts and chutes.

D. Retempering: Not permitted for concrete where cement has partially hydrated.

E. Pumping of Concrete:

1. Provide standby pump, conveyor system, crane and concrete bucket, or other system onsite during pumping, for adequate redundancy to ensure completion of concrete placement without cold joints in case of primary placing equipment breakdown.
2. Minimum Pump Hose (Conduit) Diameter: 4 inches.

3. Replace pumping equipment and hoses (conduits) that are not functioning properly.

F. Maximum Size of Concrete Placements: Limit size of each placement to allow for strength gain and volume change as a result of shrinkage.

G. Hot Weather:

1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 301, ACI 305.1, and as follows:
   a. Maintain concrete temperature below 90 degrees F at time of placement, or furnish test data or other proof that admixtures and mix ingredients do not produce flash set plastic shrinkage, or cracking as a result of heat of hydration. Cool ingredients before mixing to maintain fresh concrete temperatures as specified or less.
   b. Provide for windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.

H. Cold Weather Placement:

1. Unless otherwise permitted, shall be in accordance with requirements of ACI 306.1 and as follows:
   a. Cold weather requirements shall apply when ambient temperature is below 40 degrees F or approaching 40 degrees F and falling.
   b. Do not place concrete over frozen earth or against surfaces with frost or ice present. Frozen earth shall be thawed to acceptance of Engineer.
   c. Unless otherwise permitted, do not place concrete in contact with surfaces less than 35 degrees F; requirement is applicable to all surfaces including reinforcement and other embedded items.
   d. Provide supplemental external heat as needed when other means of thermal protection are unable to maintain minimum surface temperature of concrete as specified in ACI 306.1.
   e. Maintain minimum surface temperature of concrete as specified in ACI 306.1 for no less than 3 days during cold weather conditions.

3.02 TESTING

A. Strength Tests During the Work:

1. If concrete is being poured, the Contractor will make four concrete test cylinders for each 50 cubic yards poured or for each days pour, whichever amount of concrete is smaller.
2. Cylinders will be made and tested in accordance with ASTM C31, ASTM C172 and ASTM C39.

3. The standard age of the test shall be 28 days with the first cylinder broken at 7 days.
4. If the 7-day break exceeds the specified strength, then no further tests will be made until the 28th day.
5. If the 7-day break does not meet the specified strength, then the second cylinder will be tested at the 14th day.
6. In either event, the remaining cylinder(s) will be tested at the 28th day.
7. When the test cylinders fail to conform to the compressive strength requirements, the ESD shall have the right to order a change in the concrete mix for the remaining portions of the work. The Contractor may wish to make additional cylinders at his own expense as verification.

B. Test of Hardened Concrete In, or Removed From the Structure:

1. When the results of the strength tests of the control specimens indicate the concrete as placed does not meet specification requirements or where there is other evidence that the quality of the concrete is below specification requirements, core-boring tests shall be made in conformance with ASTM C42.
2. Core specimens will be tested by a certified testing laboratory approved by the ESD.
3. All deficiencies shall be corrected, or, if the Contractor elects, he may submit a proposal, for approval, that load tests be made.
4. If the proposal is approved, the load test shall be made by the Contractor and the test results evaluated by the ESD.
5. If any concrete shows evidence of failure during the load test, or fails the core test as evaluated, the deficiency shall be corrected. Any deficiency shall be corrected in a manner approved by the ESD.

END OF SECTION

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SECTION 03 40 00
PRECAST CONCRETE STRUCTURES

PART 1 GENERAL

1.01 SUMMARY

A. This Specification details the requirements for precast concrete wet wells and vaults. As an alternate the Engineer/Designer can also design these structures in accordance with the requirements of ASTM 478 and Section 33 05 13, Manholes.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI): 304R, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
2. ASTM International (ASTM):
   a. A36, Standard Specification for Structural Steel.
   b. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
3. Precast/Prestressed Concrete Institute (PCI): MNL-116, Standard for Quality Control of Precast and Prestressed Products.

1.03 QUALITY ASSURANCE

A. Qualifications of Precasting Manufacturers:

1. Precast Concrete and Precast Prestressed Concrete: Product of manufacturer with 3 years' experience producing precast concrete products of quality specified.
2. Precast Plant: PCI certified plant with current certification.

PART 2 PRODUCTS

2.01 MATERIALS

A. Formwork: One-piece, full length and without seams.

B. Reinforcing Steel: As specified in Section 03 30 00, Cast-in-Place Concrete.

C. Cement: As specified in Section 03 30 00, Cast-in-Place Concrete.

D. Aggregates: As specified in Section 03 30 00, Cast-in-Place Concrete, for 3/4-inch maximum size.

E. Admixtures: As specified in Section 03 30 00, Cast-in-Place Concrete.

F. Waterproofing Admixture: A crystalline waterproofing admixture shall be used where specifically indicated on the Drawings. The admixture shall conform to ASTM C 494, Type D or S. The admixture shall be of the crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete. The admixture shall cause the concrete to become sealed against penetrations of liquids from any direction and shall protect the concrete from deterioration due to harsh environmental conditions. The admixture shall be capable of sealing hairline cracks and resisting extreme hydrostatic pressure. Acceptable products are "Xypex Admix C-500 NF" by Xypex Chemical Corporation, "MasterLife® 300D" by BASF Corporation, and "Krystol Internal Membrane (KIM)" by Kryton International Inc. Submit certified letter from manufacturer of crystalline waterproofing admixture stating required dosage rate for job specific concrete mix. Precast manufacturer shall provide documentation that crystalline waterproofing admixture was included in concrete being placed.

G. Embedded Items:

1. ASTM A36 steel unless otherwise noted.
2. Anchor Studs: Headed anchor studs (HAS), deformed bar anchors (DBA), or threaded studs as manufactured by Nelson Stud Welding Co., Lorain, OH.
3. Furnish inserts for lifting as required.

H. Roof Hatches:

1. Hot-dip galvanized steel access hatch and frame designed for appropriate loading at installation site/location.
2. Hatch shall be manufacturers standard lockable hinged access cover with hold open arm and shall be provided with removable topside key wrench and inside fixed lever handle.

I. Grout: Nonshrink, nonmetallic Type II grout.

J. Waterproofing:

1. One-component moisture curing polyurethane elastomer.
2. Manufacturers and Products:
   a. 3M Co., St. Paul, MN; Scotch-Clad Waterproof Coating.
   b. Gaco Western, Seattle, WA; Gacoflex P-50.

2.02 CONCRETE MIX

A. As specified in Section 03 30 00, Cast-in-Place Concrete and as follows:

1. Design Strength: 4,500 psi at 28 days.
2. Water/Cement Ratio: 0.38 maximum.

2.03 DESIGN REQUIREMENTS

A. Precast Concrete Structures:

1. Precast concrete structures shall comply with ASTM C858 except as modified herein.
2. Design live loads shall be in accordance with ASTM C857. Design precast concrete structures to withstand site soil conditions and traffic loading of A-16 per Table 1 of ASTM C857 with a 30 percent increase due to impact. Soil lateral loads shall be as determined by ASTM C857.
3. Design shall also comply with the following restrictions:
   a. The maximum reinforcing ratio allowed is one-half the reinforcement ratio that produces a balanced strain condition.
   b. Earth pressure used in design shall be undrained fluid pressure at rest as indicated in the General Structural Notes on the Drawings.
   c. Include a live load surcharge of 2 feet of soil in the design of the walls.
   d. Structures shall be designed to be resistant to buoyant forces with ground water elevation at the top of the structure. A factor of safety of 1.1 shall be used against uplift utilizing only dead weight of the structure for resistance (structure weight divided by 1.1 shall be greater than or equal to the total buoyant force). A factor of safety of 1.5 shall be used against uplift when utilizing the weight of soil above the base extensions (the sum of the structure weight divided by 1.1 plus the soil weight above the base extensions divided by 1.5 shall be greater than or equal to the total buoyant force). Structure weight shall include only weight of walls and slabs. Weight of fillets, baffle walls, pump pads, and equipment shall not be used in the calculation of the structure weight. Unit weight of soil shall be 120 pcf. Unit weight of concrete shall be 145 pcf. Unit weight of water shall be 62.4 pcf.
4. Precast construction shall be in the form of monolithic walls or horizontal sections. Do not use panel walls.
5. Minimum wall thickness shall be 6 inches. Design knockout wall panels to accommodate loading pressures defined above.
6. Design and construct walls to be watertight.
7. Provide openings in structures for pipes and access openings as shown.

2.04 FABRICATION

A. General:

1. Comply with PCI MNL-116.

2. Reinforcing Steel:
    a. Place in position before concrete is cast.
    b. Keep clean and free from form oil or other substances harmful to bond.
3. Forms: Produce smooth surfaces.
4. Concrete: Deposit, vibrate, finish, and cure in accordance with recommended practices of ACI 304R. Steam curing is permitted.
5. Coordinate dimensions, determine type, quantity, size, and location of, and furnish necessary embedded items in precast concrete. Coordinate location of embedded items in cast-in-place concrete necessary to connect precast items.

B. Waterproofing:

1. Apply to exterior surfaces of walls, at precast plant site or at Site, in accordance with manufacturer's instructions.
2. Protect surface until installed in the Work.
3. Repair damage as approved by manufacturer.

2.05 SOURCE QUALITY CONTROL

A. Prepare minimum three standard concrete test cylinders for each 50 cubic yards or fraction thereof of concrete placed in the precast work in accordance with ASTM C31.

B. Test and record concrete strengths.

PART 3 EXECUTION

3.01 ERECTION

A. Verify that anchorage inserts are in correct locations.

B. Handle and erect precast concrete with care as recommended by manufacturer.

C. Erect precast units plumb, straight, level, square, and in proper alignment.

D. Fasten units securely in place and brace to maintain position, stability, and alignment until permanently connected and structure is complete and stable.

E. Field Cutting: Not allowed without prior approval of Engineer.

3.02 EXCAVATING AND BACKFILLING

A. Complete applicable Work specified in Sections 31 23 16, Excavation, prior to placing fill or backfill.

B. Provide 6-inch minimum thickness of structural fill as specified in Section 31 23 23, Trench Backfill over full width and length of structure base and extend a minimum 12 inches beyond the limits of the base. Backfill around the vault with structural fill.

C. Excavated material may be used for earth fill provided it conforms to the requirements processed earth fill as specified in Section 31 23 23, Trench Backfill.

3.03 PATCHING

A. Mix and place patching mixture to match color and texture of surrounding concrete and to minimize shrinkage.

B. Demonstrate patching method and obtain acceptance and approval.

3.04 FIELD QUALITY CONTROL

A. Inspection: With ESD, inspect precast structures for chips, cracks, and other damage.

B. Resolution:

1. Repair damage to satisfaction of ESD.
2. Perform re-inspection and obtain acceptance by ESD.

3.05 PROTECTION

A. Protect precast units from chipping, spalling, cracking, or other damage to the units after delivery to Site, during and after installation.

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SECTION 03 60 00
GROUT

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Furnish all materials, labor, and equipment required to provide all grout used in concrete work and as bearing surfaces for base plates, in accordance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Requirements of related work are included in Division 1 and Division 2 of these Specifications.

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1.	CRD-C 621	Corps of Engineers Specification for Non-shrink Grout
2.	ASTM C109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm cube Specimens)
3.	ASTM C144	Standard Specification for Aggregate for Masonry Mortar
4.	ASTM C531	Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts and Monolithic Surfacings
5.	ASTM C579	Test Method for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings
6.	ASTM C827	Standard Test Method for Early Volume Change of Cementitious Mixtures
7.	ASTM C1107	Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink)

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300 – Submittals.

1. Certified test results verifying the compressive strength and shrinkage and expansion requirements specified herein

2. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement, and appropriate uses for each type of grout used in the work.

1.05 QUALITY ASSURANCE

A. Field Tests

1. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the Engineer to ensure continued compliance with these Specifications. The specimens will be made by the Engineer or its representative.

a. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at 7 days, 28 days and any additional time period as appropriate.

b. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C579, Method B, at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at 7 days and any other time period as appropriate.

2. The cost of all laboratory tests on grout will be borne by the Owner, but the Contractor shall assist the Engineer in obtaining specimens for testing. The Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The Contractor shall supply all materials necessary for fabricating the test specimens, at no additional cost to the Owner.

3. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

PART 2 -- PRODUCTS

2.01 MATERIALS

A. Cement Grout

1. Cement grout shall be composed of Portland Cement and sand in the proportion specified in the Contract Documents and the minimum amount of water necessary to obtain the desired consistency. If no proportion is indicated, cement grout shall consist of one part Portland Cement to three parts sand. Water amount shall be as required to achieve desired consistency without compromising strength requirements. White Portland Cement shall be mixed with the Portland Cement as required to match color of adjacent concrete.

2. The minimum compressive strength at 28 days shall be 4,000 psi.

3. For beds thicker than 1-1/2 inch and/or where free passage of grout will not be obstructed by coarse aggregate, 1-1/2 parts of coarse aggregate having a top size of 3/8 inch should be added. This stipulation does not apply for grout being swept in by a mechanism. These applications shall use a plain cement grout without coarse aggregate regardless of bed thickness.

4. Sand shall conform to the requirements of ASTM C144.

B. Non-Shrink Grout

1. Non-shrink grout shall conform to CRD-C 621 and ASTM C1107, Grade B or C when tested at a maximum fluid consistency of 30 seconds per CDC 611/ASTM C939 at temperature extremes of 45 degrees Fahrenheit and 90 degrees Fahrenheit and an extended working time of 15 minutes. Grout shall have a minimum 28-day strength of 7,000 psi. Non-shrink grout shall be Euco N-S by the Euclid Chemical Company, Sikagrout 212 by Sika Corporation, Conspec 100 Non-Shrink Non-Metallic Grout by Conspec, or Masterflow 555 Grout by BASF Master Builder Solutions.

C. Epoxy Grout

1. Epoxy grout shall be Sikadur 32 Hi-Mod by Sika Corporation, Duralcrete LV by Tamms Industries, Euco #452 Series by Euclid Chemical, or MasterEmaco ADH 1090 RS by BASF Master Builder Solutions.

2. Epoxy grout shall be modified as required for each particular application with aggregate per manufacturer's instructions.

D. Epoxy Base Plate Grout

1. Epoxy base plate grout shall be Sikadur 42, Grout-Pak by Sika Corporation or Masterflow 648 by BASF Master Builder Solutions.

2.02 CURING MATERIALS

A. Curing materials shall be as specified in Section 03370 – Concrete Curing for cement grout and as recommended by the manufacturer for prepackaged grouts.

PART 3 -- EXECUTION

3.01 GENERAL

A. The different types of grout shall be used for the following applications unless noted otherwise in the Contract Documents. Where grout is called for in the Contract Documents which does not fall under any of the following applications, non-shrink grout shall be used unless another type is specifically referenced.

1. Cement grout shall be used for grout toppings and for patching of fresh concrete.

2. Non-shrink grout shall be used for grouting beneath base plates of structural metal framing.

3. Epoxy grout shall be used for bonding new concrete to hardened concrete.

4. Epoxy base plate grout shall be used for precision seating of base plates including base plates for all equipment such as engines, mixers, pumps, vibratory and heavy impact machinery, etc.

B. New concrete surfaces to receive cement grout shall be as specified in Section 03350 – Concrete Finishes and shall be cleaned of all dirt, grease and oil-like films. Existing concrete surfaces shall likewise be cleaned of all similar contamination and debris, including chipping or roughening the surface if a laitance or poor concrete is evident. The finish of the grout surface shall match that of the adjacent concrete. Curing and protection of cement grout shall be as specified in Section 03370 – Concrete Curing.

C. All mixing, surface preparation, handling, placing, consolidation, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

D. The Contractor, through the manufacturer of a non-shrink grout and epoxy grout, shall provide on-site technical assistance upon request, at no additional cost to the Owner.

3.02 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow.

3.03 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

3.04 GROUT INSTALLATION

A. Grout shall be placed quickly and continuously, shall completely fill the space to be grouted and be thoroughly compacted and free of air pockets. The grout may be poured in place, pressure grouted by gravity, or pumped. The use of pneumatic pressure or dry-packed grouting requires approval of the Engineer. For grouting beneath base plates, grout shall be poured from one side only and thence flow across to the open side to avoid air-entrapment.

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DIVISION 04

MASONRY

SECTION 04 05 17
MORTAR AND MASONRY GROUT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Mortar and grout for masonry construction.

B. Related sections:
1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
   a. Section 01 41 00 – Regulatory Requirements.

1.2 REFERENCES

A. ASTM International (ASTM):
1. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
2. ASTM C150 - Standard Specification for Portland Cement.
3. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
4. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
5. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
6. ASTM C476 - Standard Specification for Grout for Masonry.
7. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
8. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.

1.3 DEFINITIONS

A. Alkali: Sum of sodium oxide and potassium oxide calculated as sodium oxide.

1.4 PERFORMANCE REQUIREMENTS

A. Mortar color:
1. To be selected by OWNER from manufacturers standard colors prior to construction.

1.5 SUBMITTALS

A. Product data.

B. Shop drawings.

C. Mortar color samples.

D. Design Mixes for mortar and grout.

E. Test reports:
   1. Mortar Strength Test Results.
   2. Grout Strength Test Results.

1.6 QUALITY ASSURANCE

A. Materials for mortar and grout: Do not change source of materials which will affect the appearance of finished work after the work has started unless acceptable to ENGINEER.

1.7 PROJECT CONDITIONS

A. Environmental requirements:
   1. Cold weather requirements:
      a. Cold Weather Construction: In accordance with the building code as specified in Section 01 41 00.
      b. Provide adequate equipment for heating mortar and grout materials when air temperature is below 40 degrees Fahrenheit.
         1) Temperatures of separate materials, including water, shall not exceed 140 degrees Fahrenheit when placed in mixer.
         2) Maintain mortar temperature on boards above freezing.
   2. Hot weather requirements:
      a. Wet mortar board before loading and cover mortar to retard drying when not being used.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland cement:
   1. Type II, low alkali, containing maximum 0.6 percent total alkali in accordance with ASTM C150.

B. Hydrated lime:
   1. Type S in accordance with ASTM C207.

C. Aggregate for mortar:
   1. Fine aggregate: Sand in accordance with ASTM C144.

D. Aggregate for grout:
   1. Fine aggregate: Size Number 2 in accordance with ASTM C404.
   2. Coarse aggregate: Size Number 8 in accordance with ASTM C404.

E. Admixtures:
1. Mortar color admixture:
a. Containing maximum 15 percent lime proof, inorganic compounds, unless recommended otherwise by manufacturer.
b. Maximum 3 percent carbon black by weight of cement.
c. Factory blend for full color saturation of mortar joint.
d. Packaging for unitized jobsite mixing at ratio of 1 unit of color per sack of portland cement.
2. Grout admixture:
a. Manufacturers: One of the following or equal:
1) Sika Corp., Sika Grout Aid, Type II.
2) Concrete Emulsions, Grout Aid GA-II.
3. Mortar water repellent admixture:
a. Manufacturers: One of the following or equal:
1) Sika Corp., Sikaproof 85.
2) W.R. Grace, Dry Block Mortar.
3) BASF, Rheopel Plus Mortar Admixture.
4. Other admixtures:
a. Prohibited, unless accepted by the ENGINEER.

F. Water: Clean, clear, potable, free of oil, soluble salts, chemicals, and other deleterious substances.

G. Other materials:
1. Prohibited, unless acceptable to ENGINEER.

2.2 MIXES

A. Mortar mix:
1. Portland cement-lime mortar.
2. Mortar mix proportions by volume: As indicated in the following table:

MORTAR TYPE	PARTS BY VOLUME OF PORTLAND CEMENT	PARTS BY VOLUME OF HYDRATED LIME	AGGREGATE MEASURED IN A DAMP LOOSE CONDITION
S	1	Greater than 1/4 to 1/2	Not less than 2-1/4 and not more than 3 times the sum of the separate volumes of cementitious materials
N	1	Greater than 1/2 to 1 1/4	Not less than 2-1/4 and not more than 3 times the sum of the separate volumes of cementitious materials

3. Mortar mixing:

a. Mix on jobsite in accordance with ASTM C270.
b. Mix in mechanical mixer and only in quantities needed for immediate use.
c. Mix for minimum 3 minutes, and maximum of 5 minutes after materials have been added to mixer.

4. Measurement by volume: Measurement of constituents shall be accomplished by the use of a container of known capacity.
5. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units.
   a. Use no mortar which has been standing for more than 1 hour after being mixed.
6. Whenever 90 minutes has elapsed since last batch was mixed, completely empty mixer drum of materials and wash down before placing next batch of materials.

B. Grout mix:
1. Grout mix proportions by volume: As indicated in the following table:

TYPE OF GROUT	PARTS BY VOLUME OF PORTLAND CEMENT	PARTS BY VOLUME OF HYDRATED LIME	AGGREGATE MEASURED IN A DAMP LOOSE CONDITION	
			Fine Aggregate	Coarse Aggregate
Fine grout	1	0-1/10	2-1/4 to 3 times the sum of the volumes of the cementitious materials	-
Coarse grout	1	0-1/10	2-1/4 to 3 times the sum of the volumes of the cementitious materials	1 to 2 times the sum of the volumes of the cementitious materials

2. Grout mixing:
   a. Mix on jobsite or in a transit mix in accordance with ASTM C476.
   b. Slump: 8 to 11 inches, unless otherwise accepted by the ENGINEER.
   c. Use within 90 minutes after addition of mixing water.
   d. Mix for minimum of 5 minutes after ingredients are added and until uniform mix is attained. Grout shall have sufficient water added to produce pouring consistency without segregation.
3. Use coarse grout for hollow cell masonry units with minimum 4-inch cell dimensions in both horizontal directions.

a. Calculate cell dimension for this criterion by subtracting diameter(s) of any horizontal reinforcement crossing the cell from clear cell dimensions of the masonry unit.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Testing of grout and mortar:
   1. During progress of construction, the OWNER will have tests made to determine whether the grout and mortar, as being produced, complies with Specifications.
   2. Compressive strength tests for mortar: In accordance with ASTM C780, Annex A7 as modified in the following paragraphs.
      a. Spread mortar on the masonry units in a layer 1/2 to 5/8 inch thick.
      b. Allow mortar to stand for one minute, then remove and place in a 2-inch by 4-inch cylinder mold. Place mortar in two layers compressing the mortar using the flat end of a stick or fingers. Lightly tap the mold on opposite sides. Level off and immediately cover molds, keeping them damp until taken to the laboratory.
      c. After 48 hour set, remove mortar specimens from molds and store in a fog room until tested. Water curing (curing in tanks) is not permitted.
      d. Test specimens in damp condition.
   3. Compressive strength test for grout: In accordance with ASTM C1019.
   4. The ENGINEER will make and deliver test specimens to the laboratory and testing expense will be borne by the OWNER.
   5. Required number of tests:
      a. At least 2 test specimens of grout and mortar will be made per week.
   6. Do not use grout and mortar that does not meet specification.
      a. Remove such mortar and grout from Project site.
   7. Make provisions for and furnish grout and mortar for test specimens, and provide manual assistance to the ENGINEER in preparing test specimens.
   8. Assume responsibility for care of and providing proper curing conditions for test specimens.

3.2 ADJUSTING

A. Repair of defective masonry:
   1. Remove and replace or repair defective work.
   2. Do not patch, repair, or cover defective work without inspection by the ENGINEER.
   3. Provide repairs having strength equal to or greater than specified strength for areas involved.

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SECTION 04 05 23
MASONRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Adjustable wall ties.
2. Control joint filler.
3. Reinforcing bars.
4. Water repellent.
5. Wire joint reinforcement, single Wythe type.

B. Related sections:
1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
a. Section 04 22 00 – Unit Masonry Assemblies.

1.2 REFERENCES

A. ASTM International (ASTM):
1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
3. ASTM A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
4. ASTM A951 - Standard Specification for Masonry Joint Reinforcement.
5. ASTM C549 - Standard Specification for Perlite Loose Fill Insulation.
6. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.
7. ASTM D2287 - Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.

1.3 SUBMITTALS

A. Shop drawings.

B. Product data.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Adjustable wall ties: zinc coated fabrications, minimum 3/16-inch diameter steel wire formed into hook or pin and eye pieces, capable of restraining compression and tension forces from veneer.
   1. Manufacturers: One of the following or equal:
      a. Hohmann & Barnard, Inc
      b. Dur-O-Wal, Inc., D/A 515.
      c. Wire-Bond, 1800 Hook and 1801 Eye.

B. Control joint filler: The key shall be of the width and shape as indicated on the Drawings. In accordance with ASTM D 2000 or ASTM D 2287.
   1. Manufacturers: One of the following or equal:
      a. AA Wire Products, Inc., AA2000 Blok-Tite.
      b. Dur-O-Wall, Rapid Poly-Joint.
      c. Vert-A-Joint Co., Vert-A-Joint.

C. Reinforcing bars: In accordance with ASTM A 615, Grade 60, deformed billet steel bars.

D. Water repellent: Water based, methacrylate polymer with aqueous polysiloxane.

E. Wire joint reinforcement, single Wythe type: In accordance with ASTM A 951 with ASTM A 82, 9 gauge wire side rails and 9-gauge cross ties, sized to suit application, and galvanized in accordance with ASTM A 153, Class B (minimum 1.5 ounces zinc per square foot).
   1. Manufacturers: One of the following or equal:
      a. Wire-Bond, Ladder Type, Series 200 or 800.
      b. Hohmann & Barnard, Inc

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products as specified in Section 04 22 00.

END OF SECTION

SECTION 04 22 00
UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:
   1. Concrete Masonry Units (CMU's).
   2. Mortar and grout.
   3. Reinforcing steel.
   4. Masonry joint reinforcement.
   5. Brick masonry.
   6. Thru-wall flashing.
   7. Miscellaneous masonry accessories.

B. Related Sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
   3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
      a. Section 03 30 00 – Cast-In-Place Concrete.
      b. Section 04 05 23 – Masonry Accessories.
      c. Section 05 12 00 – Structural Steel.
      d. Section 05 50 00 – Metal Fabrications.
      e. Section 07 92 00 – Joint Sealants.

C. Products furnished, but not installed, under this Section include the following:
   1. Section 03 30 00 - Cast-in-Place Concrete.
   2. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Section 05 12 00 - Structural Steel.

D. Products installed, but not furnished, under this Section include the following:
   1. Steel lintels for unit masonry, furnished under Section 05 50 00 - Metal Fabrications.
   2. Insulation in cavity walls, Division 07.
   3. Control joint sealing, Division 07.

1.2 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops net-area compressive strengths (f'_m) of 1500 psi at 28 days.

B. Determine net-area compressive strength (f'_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to the current adopted Edition of the International Building Code.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples of face block veneer for approval of Engineer.

C. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
   3. Accessories.

D. Qualification Data: For testing agency.

E. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
   1. Masonry units.
      a. Include material test reports substantiating compliance with requirements.
   2. Cementitious materials. Include brand, type, and name of manufacturer.
   3. Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.
   4. Grout mixes. Include description of type and proportions of ingredients.
   5. Reinforcing bars.
   6. Joint reinforcement.
   7. Anchors, ties, and metal accessories.

F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports, per ASTM C780, for mortar mixes required to comply with property specification.
   2. Include test reports, per ASTM C1019, for grout mixes required to comply with compressive strength requirement.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C1093 for testing indicated, as documented according to ASTM E548.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

D. ACI Publications: Comply with the latest Edition of the following except as modified by requirements in the Contract Documents:
   1. ACI 530, Building Code Requirements for Masonry Structures.
   2. ACI 530.1, Specification for Masonry Structures.

E. ANSI "American Standard Building Code Requirements for Masonry" and "Building Code Requirements for Reinforced Masonry".

F. Contractor/Fabricator Qualifications: Provide documentation of prior work experience with projects of similar size, design, and unit type as this project and whose work has resulted in construction projects with a record of successful in-service performance.
   1. Masonry Contractor/Installer: A firm with a minimum of 5 years' experience in CMU and face brick installations with a minimum of 5 commercial type projects similar in size to this specific project and able to provide references and similar project information if so requested.

G. Conduct initial "Coordination" conference to review Contract Documents and requirements prior to any submittal. Require representatives of each entity directly concerned with Unit Masonry shall attend, including but not limited to:
   1. Engineer or representative.
   2. Contractor's superintendent.
   3. Independent testing agency responsible for masonry testing.
   4. Unit masonry subcontractor.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units and face block veneer on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry. Store and handle to avoid chipping.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store pre-blended, dry mortar mix in delivery

containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530-05/ASCE 5-05/TMS 402-05.

E. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40° F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

F. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530-05/ASCE 5-05/TMS 402-05.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

B. Regional Materials: Provide Concrete Masonry Units that have been manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

2.2 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

B. Unless otherwise indicated, 2 or 3 cell units 7-5/8" x 15-5/8" x width indicated, plus all closers, jamb units and other special sizes and shapes required to bond with and complete the work.

C. Conform to ASTM C90, cured 28 days minimum and dries for shrinkage.

D. Do not use damaged units in the work.

E. Do not use chipped units in exposed locations.

2.3 CONCRETE MASONRY UNITS (CMUS)

A. Shapes: Provide shapes indicated and as follows:
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners, unless otherwise indicated.

B. Concrete Masonry Units: ASTM C90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
2. Weight Classification: Normal weight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

C. Integral Water Repellent: Provide units made with integral water repellent for exterior units.
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.

a. Available products:
   1) Addiment Incorporated; Block Plus W-10.
   2) Grace Construction Products, a unit of W. R. Grace & Co. – Conn.; Dry-Block.
   3) Master Builders, Inc.; Rheopel.

2.4 SPLIT FACE BLOCK

A. Regional Materials: Provide brick from materials that have been manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Split face block and color to be selected by the Engineer or Owner. Block to be modular. Material cost to be included in the base bid.

C. Submit samples of selected block for the Engineer/Owner's approval.

D. Furnish matching solid block for all locations where holes would otherwise be exposed.

E. Deliver to job stacked. Do not use chipped block in exposed locations.

2.5 CONCRETE AND MASONRY LINTELS

A. Provide masonry lintels complying with requirements below.
   1. Masonry Lintels: Built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with grout. Temporarily support built-in-place lintels until cured.

B. Provide concrete lintels complying with requirements below.
   1. ASTM C1623, matching CMU's in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than CMU's.
   2. Precast or formed-in-place concrete lintels complying with requirements in Section 03 30 00. And with reinforcing bars indicated.

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

D. Masonry Cement: ASTM C 91.

1. Available Products:
    a. Capital Materials Corporation; Flamingo Color Masonry Cement.
    b. Essroc, Italcementi Group; Brixment or Velvet.
    c. Holcim (US) Inc.; Mortamix Masonry Cement, Rainbow Mortamix Custom Buff Masonry Cement, or White Mortamix Masonry Cement.
    d. Lafarge North America Inc.; Magnolia Masonry Cement, Lafarge Masonry Cement Florida Super Masonry, Trinity Super White Masonry Type S, or Trinity White Masonry Type N.
    e. Lehigh Cement Company; Lehigh Masonry Cement or Lehigh White Masonry Cement.
    f. National Cement Company, Inc.; Coosa Masonry Cement.
2. Regional Materials: Provide aggregate for mortar, cement, and lime that have been extracted, harvested, or recovered, as well as manufacture, within 500 miles of Project site.

E. Mortar Cement: ASTM C1329.
1. Available Products:
    a. Lafarge North America Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.

F. Aggregate for Mortar: ASTM C144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. Sand shall be clean, well screened, natural, ASTM C144.

G. Aggregate for Grout: ASTM C404.

H. Water: Potable.

I. Grout shall be 3,000 psi pea gravel concrete with a maximum water/cement of 0.50.Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
1. Available Products:
    a. Addiment Incorporated; Mortar Tite.
    b. Grace Construction Products, a unit of W. R. Grace & Co. – Conn; Dry-Block Mortar Admixture.
    c. Master Builders, Inc.; Rheomix Rheopel.

2.7 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951.
1. Walls: Hot-dip galvanized, carbon steel.

2. Wire Size for Side Rods: 86A (3/16).
3. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
4. Wire Size for Veneer Ties: W1.7 or 0.148-inch diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet**,** with prefabricated corner and tee units.

C. Masonry Joint Reinforcement:
1. As specified in Section 04 05 23 – Masonry Accessories.

2.8 CLEAR SURFACE TREATMENT REPELLENTS

A. In addition to the integral water repellent provided within the concrete masonry units and the integral water repellent provided within the mortar, provide a compatible clear surface treatment repellent post applied in accordance with the manufacturers recommendations to all concrete masonry work.
1. Water based, clear, specially formulated VOC compliant penetrating sealer consisting of water based blends of silanes and siloxanes to provide maximum water repellency when post applied to integrally water-repellent -treated concrete masonry unit construction.

B. Available Products:
1. INFINISEAL ® DB by Grave Construction Products.
2. Approved Equal.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

B. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
1. Available Products:
a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.

d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.10 EXPANSION AND CONTROL JOINT MATERIALS

A. Backer rod and sealant in expansion joints and sealant in control joints as specified in Section 07 92 00.

2.11 THROUGH-WALL FLASHING

A. Where shown built into masonry, and unless noted otherwise, use 5 oz. copper fabric flashing. Seal all laps with flashing mastic.

2.12 WEEP HOLE/VENT PRODUCTS

A. Weeps: Mortar Net USA, Ltd. “Mortar Net Weeps Vents” or approved equal.

2.13 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Available Manufacturers:
      a. Diedrich Technologies, Inc.
      b. EaCo Chem, Inc.
      c. ProSoCo, Inc.

2.14 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Limit cementitious materials in mortar to portland cement and lime.

B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For masonry below grade or in contact with earth, use Type S.
   2. For reinforced masonry, use Type S.
   3. For interior non-load-bearing partitions, use Type S.

D. Mortar Mixing:

1. Proportion and mix according to ASTM C270.

E. Grout for Unit Masonry: Comply with ASTM C 476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
   2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. No masonry work when ambient temperature is below 35 degrees Fahrenheit; do not build on frozen work or surface with water or frost film; protect masonry from freezing for 48 hours after being laid.

B. Lay out coursing with story pole prior to laying masonry to insure joints of uniform thickness.

C. Lay in plumb, true to line level course, head joints aligned; adjust to final position before mortar stiffens.

D. Keep cavities, chases, etc., free of debris or mortar droppings.

E. Unless otherwise required, completely fill spaces around built-in items with mortar; fill heads and jambs of hollow metal frames with mortar as the wall is laid. Install anchors, flashing, etc., as the wall is laid.

F. Tolerance of offset between vertical faces of block masonry: 1/8”.

G. Rake control joints to depth of 3/8” and leave ready for sealant.

H. Step back unfinished work for joining with new; do not "tooth" unless specifically approved. Protect tops or openings in exposed masonry walls from rain or snow with a strong waterproof membrane, adequately secured in place.

I. Do not use mortar that has begun to set; do not use mortar more than 2-1/2 hours after mixing when air temperature is 80 Degrees Fahrenheit or higher or more that 3-1/2 hours after mixing when air temperature is less than 80 Degrees Fahrenheit.

J. Brace walls to resist lateral loads in accordance with "American Standard Building Code Requirements for Masonry".

K. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

L. Build chases and recesses to accommodate items specified in this and other Sections.

M. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

N. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

O. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

P. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

Q. Comply with construction tolerances in ACI 530-05/ASCE 5-05/TMS 402-05 and with the following:
   1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.

5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.3 LAYING MASONRY WALLS

A. Laying Concrete Block.
1. General: Cut block with masonry saws. Set head joints in running bond. For other joints, provide full mortar coverage in joints on horizontal and vertical face shells, none on web edges. Bond each course at corners. Remove sharp edges and irregularities at exposed corners of concrete block work with an abrasive block.
2. Joints: 3/8” wide, struck flush.
3. Lintels: Unless otherwise noted or indicated, construct of U-shape units filled with 3000 psi concrete, extending at least 8” beyond each side of opening. Reinforce as indicated, but not less than one No. 5 bar.
4. Joint Reinforcing: Place in first (continuous) and second bed joints (to 2 feet each side of opening) above and below openings and continuous in every second bed joint throughout remainder of structure, Lap splices 6”. Bend longitudinal wires around corners to provide a continuous bond.
5. Anchors: Space not more than 16 inches o. c. vertically and 24” o. c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches around the perimeter.

3.4 MORTAR BEDDING AND JOINTING

A. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

B. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

C. Lay hollow brick and concrete masonry units as follows:
1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
3. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

D. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

3.5 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap joint reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
      a. Reinforcement above is in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.6 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:
   1. Install preformed control-joint gaskets designed to fit standard sash block.
   2. Unless indicated or noted otherwise, on the exterior, control joints shall occur at all interior corners of intersecting masonry walls.
   3. Square rake mortar cleanly to depth of 3/8” to receive sealant as specified in Division 7.

C. Provide expansion joints in exterior above grade masonry walls not to exceed 25ft O.C., placed as shown on drawings or as located and directed by Engineer.

D. Use specified expansion joint materials in all expansion joints unless otherwise directed.

E. Form expansion joints in brick made from clay or shale as follows:
   1. Build in compressible joint fillers where indicated.
   2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 07 92 00.

3.7 THROUGH-WALL FLASHING

A. Install continuous, embedded in mortar or a troweled on layer of bituminous mastic, with end joints lapped 6" and sealed with manufacturer's mylar tape, and with ends adjacent to opening jambs turned up to form a pan. Outer edge shall extend completely to face of mortar joint.

B. At rear of through-wall flashing between stud walls and brick veneer, extend through cavity and build in as shown. Extend up between sheathing and building wrap

C. Required Locations: Install through-wall flashing at heads and sills of windows, heads of doors in exterior walls, continuous under weep holes in brick veneer, and where shown.

D. Where grade slopes and weep holes above grade step with the slope, through-wall flashing shall step correspondingly and shall overlap at the stepped ends a minimum of 24". Turn up ends approximately 2" and turn into head joints of masonry.

3.8 LINTELS

A. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.9 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

3.10 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as needed. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than 60 inches.

3.11 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
   1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
   2. Comply with Level C Quality Assurance in ACI 530-1/ASCE 6/TMS 602 Latest Edition and International Building Code Chapter 17 Structural Tests and Inspection, Latest Edition and as follows:

B. Testing Frequency: One set of tests for each 1500 sq. ft. of wall area or portion thereof.

C. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for mortar air content and compressive strength.

D. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

3.12 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Engineer's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.13 CLEAR SURFACE TREATMENT REPELLENTS

A. In addition to the integral water repellent provided within the concrete masonry units and the integral water repellent provided within the mortar, provide a compatible clear surface treatment repellent post applied in accordance with the manufacturers recommendations to all concrete masonry work.

3.14 CLEANING

A. Clean off loose mortar without damage to CMU. Cut out defective joints, re-point and tool to match adjacent work.

B. Insure adequate water supply for presoaking and rinsing. Delay cleaning of any section at least 28 days after topping out.

C. Use "Sure Klean" or approved equal in strict accordance with manufacturer's instructions. Specific product shall be as recommended by the manufacturer for the type masonry involved.

D. Protect non-masonry surfaces. Masonry below the working area shall be kept wet by flushing with water

E. High pressure water cleaning methods are not permitted unless approved by the Engineer.

3.15 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner’s property.

END OF SECTION

SECTION 04 22 16
ANCHORED CMU VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Anchored CMU veneer.

B. Related sections:
1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
   a. Section 04 05 17 – Mortar and Masonry Grout.
   b. Section 04 22 00 – Unit Masonry Assemblies.
   c. Section 07 19 00 – Water Repellant Coating.
   d. Section 07 92 00 – Joint Sealants.

1.2 SUBMITTALS

A. Product data.

B. Shop drawings: Include elevations of each wall indicating type and layout of units.

C. Samples: Include samples of masonry units in sufficient quantity to illustrate color range.

D. ICC ES Evaluation Report for wall ties and anchoring system.

E. Test reports:
1. Test reports for each type of CMU.
2. Testing and reports are to be completed by and independent laboratory.
3. Test reports shall include:
   a. Compressive strength.

F. Letter of certification.

1.3 QUALITY ASSURANCE

A. Pre-installation meeting: Conduct prior to beginning masonry construction.

B. A letter of certification from the supplier of the materials attesting to compliance with the applicable specifications for grades, types, or classes included in these specifications, shall be provided at the time of, or prior to, delivery of the materials to the jobsite.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Transport and handle masonry units as required to prevent discoloration, chipping, and breakage.

B. Locate storage piles, stacks, and bins to protect materials from heavy traffic.

C. Store masonry units off ground to prevent contamination by mud, dust, or materials likely to cause staining or other defects.

D. Cover materials when necessary to protect from the elements.

E. Remove chipped, cracked, and otherwise defective units from jobsite upon discovery.

1.5 PROJECT CONDITIONS

A. Cold weather requirements:
   1. In accordance with building code as specified in Section 01 41 00.
   2. Provide adequate equipment for heating masonry materials when air temperature is below 40 degrees Fahrenheit.

B. Hot weather requirements:
   1. When ambient air temperature exceeds 100 degrees Fahrenheit, or when ambient air temperature exceeds 90 degrees Fahrenheit and wind velocity is greater than 8 miles per hour, implement hot weather protection procedures.
   2. Wet mortarboard before loading and cover mortar to retard drying when not being used.
   3. Do not spread mortar beds more than 48 inches ahead of placing masonry units.
   4. Place masonry units within 1 minute of spreading mortar.

1.6 SEQUENCING AND SCHEDULING

A. Order masonry units well before start of installation (8 weeks minimum) to assure adequate time for manufacturing.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. CMU masonry veneer units:
   1. CMU masonry veneer units as specified in Section 04 22 00.
   2. Surface texture: As specified in Section 04 22 00.
   3. Size: As specified in Section 04 22 00.

4. Special sizes and shapes: As required for window and door soldier coursing and custom sills where indicated on the Drawings, bond beams, piers, lintels, control joints, and other special applications to minimize cutting.
5. Do not exceed variations in color and texture of samples accepted by the ENGINEER.
6. Mortar and grout: As specified in Section 04 05 17.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect adjacent construction with appropriate means from mortar droppings and other effects of laying of masonry units.

B. Thoroughly clean foundations of laitance, grease, oil, mud, dirt, mortar droppings, and other objectionable matter.

3.2 INSTALLATION

A. CMU masonry veneer units:
1. Use dry masonry units.
2. Do not use wet or frozen masonry units.
3. Lay units in uniform and true courses, level, plumb, and without projections or offset from adjacent units.
4. Lay units to desired height with joints of uniform thickness.
5. For CMU veneer over masonry wall surfaces, install channel slot anchor system and reinforcing wires.
6. Spot bedding with cement mortar at all anchor locations.
7. Bond shall be plumb throughout.
8. Lay units to avoid formation of cracks when units are placed.
9. Lay masonry plumb, true to line, with courses level. Keep bond pattern plumb throughout. Lay masonry within the following tolerances:
    a. Maximum variation from the plumb in the lines and surfaces of columns, walls, and in the flutes and surfaces of fluted or split faced blocks:
        1) In adjacent masonry units: 1/8 inch.
        2) In 10 feet: 1/4 inch.
        3) In any story or 20 feet maximum: 3/8 inch.
        4) In 40 feet or more: 1/2 inch.
    b. Maximum variations from the plumb for external corners, expansion joints, and other conspicuous lines:
        1) In any story or 20 feet maximum: 1/4 inch.
        2) In 40 feet or more: 1/2 inch.
    c. Maximum variations from the level or grades indicated on the Drawings for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
        1) In any bay or 20 feet maximum: 1/4 inch.

2) In 40 feet or more: 1/2 inch.

d. Maximum variations of the linear building lines from established position in plan and related portion of columns, walls, and partitions:
   3) In any bay or 20 feet maximum: 1/2 inch.
   4) In 40 feet or more: 3/4 inch.

e. Maximum variation in cross sectional dimensions of columns and in thickness of walls:
   5) Minus: 1/4 inch.
   6) Plus: 1/2 inch.

f. When positions of units shift after mortar has stiffened, bond is broken, or cracks are formed, relay units in new mortar.

10. Prevent mortar from staining the face of masonry to be left exposed or painted:
    a. Immediately remove mortar in contact with face of such masonry.
    b. Protect all sills, ledges, and projections from droppings of mortar. Protect doorjambs and corners from damage during construction.
11. Protect masonry not being worked on from rain by completely covering with a weather resistive membrane.

B. Mortar joints:
1. Make joints straight, clean, smooth, and uniform in thickness.
2. Pointing: Tool exposed joints, slightly concave. Strike concealed joints flush.
3. Joint thickness: Make vertical and horizontal joints 3/8-inch thick.
4. Where fresh masonry joins totally or partially set masonry, clean and roughen set masonry before laying new units.

C. Bond pattern:
1. Lay masonry units in running bond pattern, except where special patterns are indicated on the Drawings.

D. Cutting masonry units:
1. When possible, use full units of the proper size in lieu of cut units. Cut units as required to form chases, openings, for anchorage, and for other appurtenances.
2. Cut and fit units with power-driven carborundum or diamond disc blade saw.

E. Control joints:
1. Control joint spacing:
   a. Provide control joints in masonry walls at locations indicated on the Drawings.
   b. If the location of control joints is not indicated on the Drawings, provide control joints at 20-foot maximum spacing. Submit proposed control joint spacing to the ENGINEER for acceptance.
2. Make full height and continuous in appearance.
3. Insert control joint filler in joints as wall is constructed.
4. Apply sealant as specified in Section 07 92 00.

F. Door frames:
1. Anchor and fully grout jambs and head of door frames connected to masonry.

2. Fill frames with grout as each 2 feet of masonry is laid.

G. Enclosures:
1. Where masonry units enclose conduit, pipes, stacks, ducts, and similar items, construct chases, cavities, and similar spaces as required, whether or not such spaces are indicated on the Drawings.
2. Point openings around flush mounted electrical outlet boxes with mortar, including flush joints above boxes.
3. Do not cover enclosures until inspected and when appropriate, tested.

H. Other embedded items:
1. Build in wall plugs, accessories, flashings, pipe sleeves, and other items required to be built-in as the masonry work progresses.

I. Patching:
1. Patch exposed masonry units in such manner that patching will be indistinguishable from similar surroundings and adjoining construction.

J. Water curing:
1. Protect masonry units from drying too rapidly by frequently fogging or sprinkling for minimum of 3 days.

K. Miscellaneous:
1. Build in required items, such as anchors, flashings, sleeves, frames, structural steel, lintels, anchor bolts, and metal fabrications, as required for complete installation.

L. Water repellent:
1. Apply water repellent as specified in Section 07 19 00.

M. Cleaning:
1. Exercise extreme care to prevent mortar splotches.
2. Do not attach construction supports to masonry walls.
3. Wash off brick scum and grout spills before scum and grout set.
4. Remove grout stains from walls.
5. Clean exposed masonry. Remove scaffolding and equipment. Dispose of debris, refuse, and surplus material offsite legally.
6. Correct efflorescence on exposed surfaces with commercially-prepared cleaning solution acceptable to masonry unit manufacturer:
    a. Apply cleaning solution in accordance with cleaning solution manufacturer's printed instructions.
    b. Do not use muriatic acid as cleaning solution.
    c. Do not use sandblast cleaning equipment.

N. Forms and shores:
1. Where required, construct forms to the shapes indicated on the Drawings:

a. Construct forms sufficiently rigid to prevent deflection which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout.
b. Do not remove supporting forms or shores until the supported masonry has acquired sufficient strength to support safely its weight and any construction loads to which it may be subjected:
1) Wait at least 16 hours after grouting masonry columns or walls before applying uniform loads.
2) Wait at least 72 hours before applying concentrated loads.

3.3 PROTECTION

A. Provide temporary protection for exposed masonry corners subject to damage.

B. Bracing:
1. Adequately brace masonry walls over 8 feet in height to prevent overturning and to prevent collapse unless wall is adequately supported by permanent supporting elements so wall will not overturn or collapse.
2. Keep bracing in place until permanent supporting elements of structure are in place.

C. Limited access zone:
1. Establish limited access zone prior to start of masonry wall construction.
2. Zone shall be immediately adjacent to wall and equal to height of wall to be constructed plus 4 feet by entire length of wall on unscaffolded side of wall.
3. Limit access to zone to workers actively engaged in constructing wall. Do not permit other persons to enter zone.
4. Keep zone in place until wall is adequately supported or braced by permanent supporting elements to prevent overturning and collapse.

3.4 FIELD QUALITY CONTROL

A. Site tests:
1. Efflorescence tests:
a. Perform efflorescence tests on mortar that will be exposed to weathering. Tests shall be scheduled far enough in advance of starting masonry work to permit retesting if necessary.

END OF SECTION

DIVISION 05

METALS

SECTION 05 12 00
STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Structural steel.
   2. Grout.

B. Related sections:
   1. Division 01 Section "Quality Control" for independent testing agency procedures and administrative requirements.
   2. Section 05 50 00, METAL FABRICATIONS for steel lintels or shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.
   3. Section 09 90 00, PAINTING AND PROTECTIVE COATINGS for surface preparation and priming requirements.

1.2 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.

C. Welding certificates.

D. Qualification Data: For Installer and fabricator.

E. Mill Test Reports: Signed by Manufacturers certifying that the following products comply with requirements:
   1. Structural steel including chemical and physical properties.
   2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   3. Shop primers.

4. Non-shrink grout.

F. Source quality-control test reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who regularly erects structural steel with scope and complexity similar to that of this project.

B. Fabricator Qualifications: A qualified fabricator who regularly fabricates structural steel with scope and complexity similar to that of this project.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

D. Comply with applicable provisions of the following specifications and documents:
1. AISC "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC "Seismic Provisions for Structural Steel Buildings" and "Supplement No.2."
3. AISC "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
4. AISC "Specification for the Design of Steel Hollow Structural Sections."
5. AISC "Specification for Allowable Stress Design of Single-Angle Members".
6. RCSC "Specifications for Structural Joints Using ASTM F 3125 Bolts.

E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, PROJECT MANAGEMENT AND COORDINATION and Section 01 12 00 PROJECT MEETINGS.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
1. Store fasteners in a protected place. Re-lubricate bolts and nuts that become dry.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
3. Do not clean and use rusty bolts.

1.6 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992.

B. Channels, Angles, and Shapes: ASTMA A 36 unless otherwise noted.

C. Plate and Bar: ASTM A 36 unless otherwise noted.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B structural tubing.

E. Steel Pipe: ASTM A53, Type E or S, Grade B.
   1. Weight Class: Standard unless otherwise indicated.
   2. Finish: Black, except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements. Tensile strength should be the same or greater than base metal.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM F 3125 Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon steel nuts; and ASTM F 436 hardened carbon-steel washers.
   1. Finish: Plain unless noted or indicated otherwise.

B. Un-headed Anchor Rods: ASTM F 1554, Grade 36, unless otherwise indicated.
   1. Configuration: as indicated.
   2. Nuts: ASTM A 563, heavy hex carbon steel.
   3. Plate Washers: ASTM A 36 carbon steel.
   4. Washers: ASTM F 436, hardened carbon steel.
   5. Finish: Plain, unless noted or indicated otherwise.

C. Threaded Rods: ASTM A 36.
   1. Nuts: ASTM A 563 heavy hex carbon steel.
   2. Washers: ASTM F 436 hardened carbon steel.
   3. Finish: Plain, unless noted or indicated otherwise.

D. Clevises or turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.

E. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

F. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 PRIMER

A. Primer: Fabricator’s standard lead and chromate free non-asphaltic rust inhibiting primer.

B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, non-corrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time and complying with Section 03 60 00 GROUT.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC "Code of Standard Practice for Steel Buildings and Bridges" and AISC "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design".
   1. Camber structural-steel members where indicated.
   2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
   3. Mark and match-mark materials for field assembly.
   4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."

F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

G. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10" o.c., unless otherwise indicated.

H. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces.
   2. Base-Plate Holes: Cut, drill, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC "Specification for Structural Joints Using ASTM F 3125 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
   1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
   2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2".
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials.
   5. Galvanized surfaces.

B. Surface Preparation: Clean the surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to Manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint comers, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, non-asphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
   1. Fill vent holes and grind smooth after galvanizing.

2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedment, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
   1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design".

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
   1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of base plate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and base or bearing; plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow it to cure. Comply with Manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

C. Splice members only where indicated.

D. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.

E. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC "Specification for Structural Joints Using ASTM F 3125 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened, unless noted or indicated otherwise.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
   1. Comply with AISC "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design", for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
   3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC "Specification for Structural Joints Using ASTM F 3125 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and Manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
   2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 09 90 00, PAINTING AND PROTECTIVE COATINGS.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 -- GENERAL

1.01 REQUIREMENT

A. Furnish all materials, labor, and equipment required to provide all metal fabrications not specifically included in other Sections, complete and in accordance with the requirements of the Contract Documents.

B. Work shall include but may not be limited to lintels and guard posts.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Certain specific items are included in other Sections of the Specifications. See the Section for the specific item in question.

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of other requirements of the Specifications, all work specified herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. 2009 International Building Code

2. AISC – Specification for Structural Steel Buildings

3. AISI – Specifications for the Design of Cold-Formed Steel Structural Members

4. Aluminum Association Specifications for Aluminum Structures

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300 – Submittals:

1. Complete fabrication and erection drawings of all metalwork specified herein

PART 2 -- PRODUCTS

2.01 METAL MATERIALS

A. Metal materials used in metal fabrications shall conform to Section 05010 – Metal Materials, unless noted otherwise.

2.02 METAL FASTENING

A. All welds and fasteners used in metal fabrication shall conform to Section 05050 – Metal Fastening, unless noted otherwise.

2.03 GUARD POSTS (BOLLARDS)

A. Guard posts shall be 6-inch diameter, Schedule 40 galvanized steel pipe in accordance with ASTM A53.

B. Guard posts shall be concrete-filled and crowned as detailed on the Drawings.

PART 3 -- EXECUTION

3.01 FABRICATION

A. All measurements and dimensions shall be based on field conditions and shall be verified by the Contractor prior to fabrication. Such verification shall include coordination with adjoining work.

B. All fabricated work shall be shop-fitted together as much as practicable and delivered to the field complete and ready for erection. All miscellaneous items such as stiffeners, fillets, connections, brackets, and other details necessary for a complete installation shall be provided.

C. All work shall be fabricated and installed in a manner that will provide for expansion and contraction; prevent shearing of bolts, screws, and other fastenings; ensure rigidity; and provide a close fit of sections.

D. Finished members shall conform to the lines, angles, and curves shown on the Drawings and shall be free from distortions of any kind.

E. All shearings shall be neat and accurate, with parts exposed to view neatly finished. Flame cutting is allowed only when performed utilizing a machine.

F. All shop connections shall be welded unless otherwise indicated on the Drawings or specified herein. All fastenings shall be concealed where practicable.

G. Fabricated items shall be shop painted when specified in the appropriate Section of the Specifications.

3.02 INSTALLATION

A. Assembly and installation of fabricated system components shall be performed in strict accordance with manufacturer's recommendations.

B. All miscellaneous metalwork shall be erected square, plumb and true, and shall be accurately fitted, adequately anchored in place, and set at proper elevations and positions.

C. Metal work shall be field painted when as specified as directed by the Owner and/or Engineer.

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DIVISION 06

WOOD AND PLASTICS

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Miscellaneous wood items.
   2. Plywood backing panels.

1.2 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NeLMA: Northeastern Lumber Manufacturers' Association.
   2. NLGA: National Lumber Grades Authority.
   3. SPIB: The Southern Pine Inspection Bureau.

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all rough carpentry, unless otherwise indicated and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
   3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
   4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
   5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

A. Maximum Moisture Content: 19 percent.

B. Miscellaneous framing: Construction, Stud, or No. 3 grade of any species.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber as required and lumber for support or attachment of other construction.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.7 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

C. Adhesives for Gluing to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Do not splice structural members between supports, unless otherwise indicated.

D. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

F. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 06 16 00
SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Roof sheathing.

B. Related Requirements:
   1. Section 06 10 00 – Rough Carpentry, for plywood backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
   3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For following products, from ICC-ES:
   1. Preservative-treated plywood.
   2. Fire-retardant-treated plywood.
   3. Foam-plastic sheathing.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory.".

2.2 WOOD PANEL PRODUCTS

A. Plywood: Either DOC PS 1 or DOC PS 2 unless otherwise indicated.

B. Oriented Strand Board: DOC PS 2.

C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

D. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings, and the following:
   1. Roof and wall sheathing within 48 inches of fire walls.
   2. Roof sheathing.
   3. Subflooring and underlayment for raised platforms.

2.5 ROOF SHEATHING

A. Plywood Roof Sheathing: Exposure 1 sheathing.
   1. Span Rating: Not less than 24/0.
   2. Nominal Thickness: Not less than 15/32 inch.

B. Oriented-Strand-Board Roof Sheathing: Exposure 1 sheathing.
   1. Span Rating: Not less than 24/0
   2. Nominal Thickness: Not less than 15/32 inch.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
   1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
   1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
   2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

G. Screws for Fastening Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

2.7 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 or ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
   1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
   3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:
   1. Combination Subfloor-Underlayment:
      a. Glue and nail to wood framing.
      b. Screw to cold-formed metal framing.
      c. Space panels 1/8 inch apart at edges and ends.
   2. Subflooring:
      a. Glue and nail to wood framing.
      b. Screw to cold-formed metal framing.
      c. Space panels 1/8 inch apart at edges and ends.

3. Wall and Roof Sheathing:
    a. Nail to wood framing.
    b. Screw to cold-formed metal framing.
    c. Space panels 1/8 inch apart at edges and ends.
4. Underlayment:
    a. Nail or staple to subflooring.
    b. Space panels 1/32 inch apart at edges and ends.
    c. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.

END OF SECTION

SECTION 06 17 53
SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Wood roof trusses.
2. Wood truss bracing.
3. Metal truss accessories.

B. Related Requirements:
1. Section 06 16 00 – Sheathing, for roof sheathing and subflooring.

1.2 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For wood-preservative-treated lumber, fire-retardant-treated lumber, metal-plate connectors, metal truss accessories, and fasteners.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Shop Drawings: Show fabrication and installation details for trusses.
1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.

3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
6. Show splice details and bearing details.

C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For metal connector-plate manufacturer, professional engineer, and fabricator.

B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.

C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.

D. Evaluation Reports: For the following, from ICC-ES:
1. Wood-preservative-treated lumber.
2. Fire-retardant-treated wood.
3. Metal-plate connectors.
4. Metal truss accessories.

1.5 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Engineer and authorities having jurisdiction and is certified for chain of custody by an FSC-accredited certification body.

C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having

jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations in TPI BCSI**,** "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
   1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
   2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
   3. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design metal-plate-connected wood trusses.

B. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
   1. Design Loads: As indicated.
   2. Maximum Deflection Under Design Loads:
      a. Roof Trusses: Vertical deflection of 1/360 of span.
      b. Floor Trusses: Vertical deflection of 1/600 of span.

C. Comply with applicable requirements and recommendations of the following publications:
   1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
   2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
   3. TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
   3. Provide dressed lumber, S4S.
   4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.

B. Minimum Chord Size for Roof Trusses: 2 by 6 inches nominal for top chords 2 by 4 inches nominal for bottom chords.

C. Minimum Specific Gravity for Top Chords: 0.50.

D. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06 10 00 "Rough Carpentry."

2.3 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
   2. For exposed trusses indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
   1. For exposed trusses indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat trusses where indicated on Drawings.

2.4 FIRE-RETARDANT-TREATED WOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction,

and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high-temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
   1. For exposed trusses and bracing indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.

E. For exposed trusses indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings.

2.5 METAL CONNECTOR PLATES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   1. Alpine Engineered Products, Inc.; a division of ITW Building Components Group, Inc.
   2. MiTek Industries, Inc.
   3. Truswal Systems Corporation.

B. Source Limitations: Obtain metal connector plates from single manufacturer.

C. General: Fabricate connector plates to comply with TPI 1.

D. Hot-Dip Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 (Z180) coating designation; and not less than 0.036 inch thick.
   1. Use for interior locations unless otherwise indicated.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
   2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

2.7 METAL FRAMING ANCHORS AND ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Simpson Strong-Tie Co., Inc.
   2. USP Structural Connectors.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
   1. Use for interior locations unless otherwise indicated.

D. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch thick.
   1. Use for wood-preservative-treated lumber and where indicated.

E. Stainless-Steel Sheet: ASTM A 666, Type 304.
   1. Use for exterior locations and where indicated.

F. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fastens to one side of truss, top plates, and side of stud below.

G. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of truss and fastens to both sides of truss, top plates, and one side of stud below.

H. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/2 inches wide by 0.062 inch thick. Tie fits over top of truss and fastens to both sides of truss, inside face of top plates, and both sides of stud below.

I. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches wide by 0.050 inch thick. Clip is fastened to truss through slotted holes to allow for truss deflection.

J. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches wide by 1 inch deep by 0.040 inch thick, made to fit between two adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

B. Protective Coatings: SSPC-Paint 22, epoxy-polyamide primer or SSPC-Paint 16, coal-tar epoxy-polyamide paint.

2.9 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
   1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.10 SOURCE QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.

1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.
2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.

B. Correct deficiencies in Work that special inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

H. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
1. Install bracing to comply with Section 06 10 00 "Rough Carpentry."

I. Install wood trusses within installation tolerances in TPI 1.

J. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

K. Replace wood trusses that are damaged or do not meet requirements.
1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Engineer.

3.2 REPAIRS AND PROTECTION

A. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

C. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.
   1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

END OF SECTION

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DIVISION 07

THERMAL AND MOISTURE CONTROL

SECTION 07 19 00
WATER REPELLENT COATING

PART 1 - GENERAL

1.1 SCOPE

A. Provide transparent water repellent coating on exterior brick surfaces.

1.2 QUALITY ASSURANCE

A. Provide 5-year warranty for water repellent coatings, guaranteeing the installation waterproof and watertight, except for structural cracks or opening caused by settling, expansion or contraction.

1.3 SUBMITTALS

A. Comply with Section 01 33 00, SUBMITTAL PROCEDURES.
   1. Product Data: Submit manufacturer's installation instructions and general recommendations.
   2. Warranty: Submit copy of 5-year warranty.

1.4 JOB CONDITIONS

A. Do not proceed with the application (except with the written recommendation of the manufacturer) when ambient temperature is less than 50°F; or when rain or temperatures below 40°F are predicted for a period of 24 hours; or within 3 days after surfaces became wet from rainfall or other moisture sources.

PART 2 - PRODUCTS

2.1 TRANSPARENT WATER REPELLENT COATING:

A. ProSoCo SureKleen Weatherseal SS or Chemstop Regular Masonry Waterproofing.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces to receive water repellent treatment and the conditions under which water repellent coat is to be applied. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 APPLICATION:

A. Comply with manufacturer's instructions and recommendations, using airless spraying procedure.
   1. Protect adjoining work from spillage or blow-over of water repellent. Cover live plant materials with drop cloths. Clean spillage of water repellent as

recommended by manufacturer, from adjoining surfaces immediately after spillage.

2. Transparent Coating: Apply heavy, saturation-type, spray coating of water repellent to surfaces specified for treatment.

END OF SECTION

SECTION 07 21 00
BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Rigid insulation
   2. Perimeter insulation
   3. Glass-fiber blanket insulation
   4. Accessories

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Specifications on materials describing insulation properties and characteristics.

C. Installation instructions from Manufacturer including special procedures and conditions requiring special attention. Product test reports.Research/evaluation reports.PRODUCT HANDLING

A. Do not allow insulation materials to become wet or soiled. Comply with manufacturer's instructions for handling, storage, and protection during installation.

1.4 JOB CONDITIONS

A. Do not proceed with the installation of insulation until the work which follows (and which conceals the insulation is scheduled to follow immediately.

1.5 QUALITY ASSURANCE

A. Concealed insulation shall have a flamespread rating of not more than 75 and smoke developed rating not more than 450.

B. Exposed insulation shall have a flamespread rating of not more than 25 and smoke developed rating not more than 450.

C. Foam Insulation: Edge or face of each piece of insulation shall bear label of an approved agency. Label shall contain manufacturer's or distributor's identification, model number, serial number of definitive information describing the products or materials performance characteristics and approved agency's identification.

PART 2 - PRODUCTS

2.1 RIGID INSULATION

A. Polyisocyanurate Board Insulation: ASTM C 1289, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   1. Thicknesses: 2” at exterior CMU walls.
   2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      1) DiversiFoam Products.
      2) Dow Chemical Company (The).
      3) Owens Corning.
      4) Pactiv Building Products
      5) Approved Equal.

B. Rigid Perimeter Insulation: Expanded or extruded polystyrene plastic foam in rigid board form, 1” thick, meeting Federal Spec. HH-I-524C and ASTM C 578. Board shall be in 24” widths or as shown.

2.2 INSULATION: GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. CertainTeed Corporation.
   2. Guardian Building Products, Inc.
   3. Johns Manville.
   4. Knauf Insulation.
   5. Owens Corning.
   6. Approved Equal.

B. Sound Insulation Batts: Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics, 6” thickness.

A. Provide adhesive for bonding insulation, mechanical anchors and fasteners, retainer strips, tape, and other components and accessories indicated or required by project conditions as recommended by insulation manufacturer.

2.3 INSULATION: EXPANDED POLYSTYRENE BEADED INSULATION

A. Provide Expanded Polystyrene Beaded Insulation and fill entirely all non-grouted CMU wall cells.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.2 INSTALLATION OF PERIMETER INSULATION

A. On horizontal surfaces under slabs, loosely lay insulation units as shown on the drawings and according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in and 4” down from exterior walls.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

A. Rigid Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Rigid Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

END OF SECTION

SECTION 07 41 13
METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Architectural standing seam metal roofing.
2. Structural supports.
3. Underlayment.
4. Eave protection.
5. Metal fasciae, flashings, and trim.
6. Metal gutters and downspouts.

B. Related Sections:
1. Section 03 11 00 - Concrete Formwork
2. Section 06 16 00 - Sheathing
3. Section 07 21 00 - Building Insulation
4. Section 07 42 13.53 – Metal Soffit Panels
5. Section 07 92 00 - Joint Sealants
6. Section 09 90 00 - Painting and Coating
7. Section 26 41 13 - Facility Lightning Protection for Structures

1.2 REFERENCE STANDARDS

A. American Architectural Manufacturers Association:
1. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
2. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
3. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. American Iron and Steel Institute:
1. AISI NASPEC - North American Specification for the Design of Cold-Formed Steel Structural Members.

C. American Society of Civil Engineers:
1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

D. ASTM International:

1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
3. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
4. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
5. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
6. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
7. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
8. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
9. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
10. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
11. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
12. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
13. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
14. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

E. Federal Specification Unit:
1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

F. National Roofing Contractors Association:
1. NRCA - Roofing and Waterproofing Manual.

G. Sheet Metal and Air Conditioning Contractors' National Association:
1. SMACNA - Architectural Sheet Metal Manual.

H. UL:
1. UL 580 - Tests for Uplift Resistance of Roof Assemblies.

I. U.S. Environmental Protection Agency:
1. ENERGY STAR - ENERGY STAR Voluntary Labeling Program.

1.3 COORDINATION

A. Coordinate Work of this Section with Work of Section 03 11 00 – Concrete Formwork and 04 22 00 – Unit Masonry Assemblies for installing recessed flashing reglets.

B. Coordinate Work of this Section with Work of Section 07 21 00 – Building Insulation for insulation installed within roof assembly.

1.4 SUBMITTALS

A. Product Data:
   1. Submit fabricator information on metal types, finishes, and characteristics.
   2. Submit color charts for finish selection.

B. Shop Drawings:
   1. Indicate metal roofing panel profiles, jointing patterns, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples:
   1. Submit two samples, 24 inch by 24 inch in size, illustrating typical metal roofing mounted on plywood backing, seam, material, and finish.

D. Fabricator's Certificate: Certify that products meet or exceed specified requirements.

E. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for metal roofing and structural support.

F. Fabricator Instructions: Submit detailed instructions on installation requirements, including special procedures for roofing penetrations, flashings, and perimeter conditions requiring special attention.

G. Qualifications Statements:
   1. Submit qualifications for fabricator, installer, and licensed professional.
   2. Submit fabricator's approval of installer.

1.5 QUALITY ASSURANCE

A. Calculate structural properties of framing members according to AISI NASPEC.

B. Perform Work according to SMACNA Architectural Sheet Metal Manual and NRCA Roofing and Waterproofing Manual.

C. Perform Work according to Huntsville Utility standards.

D. Maintain two copies of each standard affecting Work of this Section on Site.

1.6 QUALIFICATIONS

A. Fabricator: Company specializing in fabricating products specified in this Section with minimum five years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum five years' documented experience.

C. Licensed Professional: Professional Engineer experienced in design of specified Work and licensed in the state of Alabama.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:
   1. Store materials according to fabricator instructions.
   2. Stack material to provide ventilation and to prevent twisting, bending, and abrasion.
   3. Slope metal sheets to ensure drainage.

D. Protection:
   1. Prevent contact with materials causing discoloration or staining.
   2. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   3. Provide additional protection according to fabricator instructions.

1.8 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

1.9 WARRANTY

A. Section 01 74 00 – Warranties and Bonds

B. Furnish 30 year fabricator's warranty for sheet metal roofing against structural failure, corrosion, and water penetration.

C. Furnish 30 year manufacturer's warranty for metal finish against fading, chipping, chalking, and blistering.

PART 2 - PRODUCTS

2.1 MANUFACTURED SHEET METAL ROOFING

A. Manufacturers:
   1. AEP Span
   2. McElroy Metals
   3. Petersen Aluminum Corporation
   4. Approved equal

B. Gutter and Downspout Components: Comply with applicable code for size and method of rain water discharge.
   1. Material and color to match fascia.

C. Accommodate following for exterior components without damage to system or components or causing deterioration of seals:
   1. Movement within system.
   2. Movement between system and perimeter framing components.
   3. Dynamic loading and release of loads.
   4. Deflection of structural support framing.
   5. Expansion and contraction over temperature range of 170 deg. F during 12-hour period.

D. Architectural Standing Seam Metal Roofing:
   1. Description: Factory-formed metal roofing panel system with concealed fasteners.
   2. Panel Materials:
      a. Material: Prefinished, 22 gauge minimum steel sheet.
   3. Panel Width: Nominal 18 inches.
   4. Panel Profile: Flat.
   5. Seam Type: Standing seam, snap interlocked.
   6. Seam Height: 1 3/4 inches.
   7. Color: As selected.

E. Metal Soffit Panels: Refer to Section 07 42 13.53.

F. Structural Supports:
   1. Description:
      a. Engineered truss system.
      b. Roof rafters.
      c. Plywood sheathing.

2.2 MATERIALS

A. Sheet Metal:
   1. Description: Prefinished galvanized steel, coil coated.
   2. Comply with ASTM A755.

a. Base Metal:
   1) Comply with ASTM A653.
   2) Quality: Architectural
   3) Zinc Coating: Class G90.
b. Exposed Finish Coating: Fabricator's Standard.
c. Unexposed Finish Coating: Fabricator's Standard.

2.3 FABRICATION

A. Form section shapes as indicated on Drawings, accurate in size, square, and free from distortion or defects.

B. Fasciae, Trim, Flashings, and Other Metal Components:
   1. Same material as metal roof panels.
   2. Provide exposed metal surfaces with same finish as exposed face of metal roof panels.

C. Cleats:
   1. Material: Same as sheet.
   2. Interlock with sheet.

D. Starter Strips:
   1. Description: Continuous, to interlock with sheet.
   2. Material: Same as sheet.

E. Form pieces in longest practical lengths.

F. Hems and Seams:
   1. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
   2. Hem exposed edges on underside 1/2 inch.
   3. At moving joints, use sealed and lapped bayonet-type or interlocking hooked seams.

G. Corners:
   1. One piece.
   2. Minimum Leg Length: 18 inches.
   3. Miter and seam corners and seal with sealant.

H. Flashings:
   1. Allow toe to extend 2 inches over roofing.
   2. Return and brake edges.

I. Gutters:
   1. Profile: As indicated on Drawings.
   2. Size: As indicated on Drawings.

J. Downspouts:
   1. Profile: As indicated on Drawings.
   2. Size: As indicated on Drawings.

K. Profile and Size of Accessories:
   1. Anchorage Devices: Type as recommended by fabricator.
   2. Gutter Supports: Brackets.
   3. Downspout Supports: Brackets.

2.4 ACCESSORIES

A. Fasteners:
   1. Material: Same material as roofing material.
   2. Washers: Same material as washers.

B. Underlayment:
   1. Description: Unperforated asphalt felt.
   2. Type: I, No. 15.
   3. Comply with ASTM D226/D226M.

C. Slip Sheet: Rosin-sized building paper.

D. Protective Backing Paint: Zinc-molybdate alkyd

E. Sealant:
   1. Type:Silicone.

F. Plastic Cement: Comply with ASTM D4586/D4586M, Type I.

G. Reglets:
   1. Type: Surface Mounted.
   2. Material: Galvanized Steel.
   3. Face and Ends: Uncovered.

H. Splash Pads:
   1. Type: Precast concrete.
   2. **S**ize and Profiles: As indicated on Drawings.
   3. Minimum Compressive Strength: 3,000 psi at 28 days.
   4. Minimum Air Entrainment: 5 percent.

I. Downspout Boots:
   1. Material: Steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Wood and Metal Deck Substrate:
   1. Inspect roof deck to verify that deck is clean and smooth; free of depressions, waves, or projections; and properly sloped.
   2. Verify that deck is dry.
   3. Verify that wood nailers are installed and correctly located.

C. Structural Framing Substrate:
   1. Verify that primary and secondary framing members are installed and fastened, properly aligned, and sloped.
   2. Verify that damaged shop coatings are repaired with touchup paint.

D. Verify that roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets are in place, and nailing strips are located properly.

E. Verify that roofing termination and base flashings are in place, sealed, and secure.

F. Verify that insulation is installed and ready for roof application.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Wood and Metal Deck Substrate:
   1. Fill knot holes and surface cracks with latex filler at areas of bonded eave protection.
   2. Broom clean deck surfaces under eave protection and underlayment.

C. Back paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mils.

3.3 INSTALLATION

A. Structural Supports:
   1. As indicated on Drawings.
   2. Align supports with top surface in plane, uniformly sloped to eaves.
   3. Spacing:

a. Maximum 4 feet o.c.
b. Provide support at roof panel end laps.

4. Secure supports to building structural frame with mechanical fasteners.

B. Underlayment:
1. Apply underlayment in single layer fastened to substrate.
2. Lay perpendicular to slope.
3. Weather-lap edges 2 inches and nail in place.
4. Stagger end joints minimum 24 inches.
5. Apply slip sheet in one layer, laid loose.

C. Standing Seam Metal Roofing:
1. Installation Standards: Install Work according to Huntsville Utility standards.

D. Soffit Panels: As indicated in Section 07 42 13.53.

E. Flashing:
1. Reglets:
a. Insert flashings into reglets to form tight fit.
b. Secure in place with plastic wedges at maximum 6 inches o.c.
c. Seal flashings into reglets with sealant.
2. Fascia:
a. Place metal flashings tight to fascia.
b. Weather-lap joints 2 inches and seal with plastic cement.
c. Secure flange to substrate.
3. Valleys:
a. Form valleys with sheet metal not exceeding 10 feet in length.
b. Lap joints 6 inches in direction of drainage.
c. Extend valley sheet minimum 6 inches under roofing sheets.
4. Fasteners:
a. Secure flashings in place using concealed fasteners.
b. Use exposed fasteners only where permitted.
5. Secure flashing exposed edges with continuous cleats.
6. Apply plastic cement compound between metal flashings and felt flashings.
7. Fit flashings tight in place, making corners square, surfaces true and straight in planes, and lines accurate to profiles.
8. Seal metal joints watertight.

F. Gutters and Downspouts:
1. Built-In Gutters:
a. Secure gutter lining to substrate with cleats spaced minimum 24 inches o.c. along edges of gutters.
b. Longitudinal joints not acceptable.
2. Roof Edges:
a. Extend gutter lining under metal roofing minimum 6 inches and terminate in 3/4 inch folded edge secured by cleats.

b. Hook lower end of roofing into lock strip to form 3/4-inch wide loose-lock seam.

3. Secure gutters and downspouts in place using concealed fasteners.
4. Slope gutters minimum 1/4 in./ft.
5. Sealing:
   a. Seal gutters watertight.
   b. Seal joint of gutter to drain.
6. Downspouts:
   a. Connect to downspout boots.
   b. Connection: Seal watertight.
7. Set splash pads under downspouts and secure in place.

G. Snow Guards:
1. According to manufacturer instructions.
2. Install in continuous line, 12 inches upslope of exterior wall.
3. Provide one additional line of snow guards for every 15 feet measured along roof slope.

3.4 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Do not permit traffic over unprotected roof surface.

END OF SECTION

SECTION 07 42 13.53
METAL SOFFIT PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes aluminum soffit panels.

B. Related Sections:
1. Section 07 41 13 Metal Roof Panels.

1.2 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.3 SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:
1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of flashing, trim, and anchorage systems.

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

D. Qualification Data: For Installer.

E. Product Test Reports: For each product, tests performed by a qualified testing agency.

F. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.6 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.7 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within 2 years of substantial completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
   1. Wind Loads: 20 PSF
   2. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
   1. Test-Pressure Difference: 1.57 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.

2.2 METAL SOFFIT PANELS

A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels:
1. Finish: Match color of metal roof panels. Refer to Section 07 41 13.
2. Sealant: Factory applied within interlocking joint.

C. V-Groove-Profile Metal Soffit Panels: Perforated panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. AEP Span; a BlueScope Steel company.
b. Architectural Building Components.
c. ATAS International, Inc.
d. Berridge Manufacturing Company.
e. CENTRIA Architectural Systems.
f. Dimensional Metals, Inc.
g. Englert, Inc.
h. Fabral.
i. Firestone Metal Products, LLC.
j. Innovative Metals Company, Inc.
k. MBCI; a division of NCI Building Systems, L.P.
l. McElroy Metal, Inc.
m. Merchant & Evans Inc.
n. Metal-Fab Manufacturing, LLC.
o. Metal Sales Manufacturing Corporation.
p. Petersen Aluminum Corporation.
q. Ultra Seam, Inc.
2. Material: Aluminum.
3. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
a. Thickness: As required by performance requirements, minimum 0.32” thickness.
b. Surface: Smooth, flat finish.

c. Exterior Finish: Two-coat fluoropolymer.

4. Panel Dimensions: As shown on drawings.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
   5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:
   1. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
   1. Examine supporting substrates to verify support members and anchorage are within alignment and flatness tolerances required by metal soffit panel manufacturer.
      a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.
   1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with performance requirements and assemblies indicated.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving metal panels.
   2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
   3. Install screw fasteners in predrilled holes.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Install flashing and trim as metal panel work proceeds.
   6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
   1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

2. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
3. Stainless-Steel Panels: Use stainless-steel fasteners.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

E. Watertight Installation:
1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24

inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 92 00
JOINT FILLERS, SEALANTS AND CAULKING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Furnish labor, materials, equipment and appliances required for the complete execution of Work shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 – Submittals

B. Section 03 15 00 – Concrete Accessories

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ASTM C920 Elastomeric Joint Sealants

2. ASTM D1056 Flexible Cellular Materials - Sponge or Expanded Rubber

3. SWRI Sealant and Caulking Guide Specification

1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01300 – Submittals, submit the following:

1. Manufacturers literature and installation instructions

2. Color samples of each type of sealant

1.05 QUALITY ASSURANCE

A. Applicator shall be a company specializing in the installation of sealants with a minimum of five years experience.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in unopened labeled packages.

B. Store materials in location protected from freezing or damages.

C. Reject and remove from the site materials within broken or damaged packaging.

PART 2 -- PRODUCTS

2.01 MATERIALS

A. Sealants

1. Type 1: Multi-component, non-sag, low-modulus polyurethane rubber sealant meeting ASTM C920, Type M, Grade NS, Class 25, use NT, M, A, and O. Capable of withstanding 50% in extension or compression such as Sikaflex-2C NS/SL by Sika Corporation, Sonolastic NP-2 by Sonneborn, or DynaTrol II by Pecora Corporation.

2. Type 2: Single component polyurethane sealant meeting ASTM C920, Type S, Grade NS, Class 25, Use NT, M, A, and O. Capable of withstanding 25% in extension or compression such as Sikaflex 1A by Sika Corporation, DynaTrol 1-XL by Pecora Corporation, or Sonolastic NP-1 by BASF Construction Chemicals.

3. Type 3: Single component, low-modulus moisture curing silicone meeting ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G, and A. Capable of withstanding 50% extension and compression such as Pecora 890 by Pecora Corporation or Sonolastic Omni Seal by BASF Construction Chemicals.

4. Type 4: Single component, mildew resistant, moisture-curing silicone meeting ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G, and A such as Pecora 898 by Pecora Corporation or Sonolastic Omni Plus by BASF Construction Chemicals.

5. Type 5: Single component, acrylic latex meeting ASTM C834 such as AC-20+ Silicone by Pecora Corporation or Sonneborn Sonolac by BASF Construction Chemicals.

6. Type 6: High grade butyl sealant meeting Federal Specification TT-S-00-1657 such as BC-158 by Pecora Corporation or equal.

7. Type 7: Multi-component chemical resistant polysulfide sealant conforming to ASTM C920, Type M, Grade NS, Class 25 such as Deck-O-Seal by W.R. Meadows, Tammsflex by DuraJoint Concrete Accessories, or Synthacalk GC2+ by Pecora Corporation.

8. Type 8: Nonsag, Multi Component, traffic grade polyurethane sealant meeting ASTM C920, Type 19, Grade NS, Class 25, use T, M, A, and O such as DynaTread by Pecora Corporation or Sonolastic Ultra by BASF Construction Chemicals.

B. Primer: Non-staining primer recommended by sealant manufacturer for the substrates on this project.

C. Backer Rod: Closed cell foam, nonreactive with caulking materials, non-oily, and approved by the sealant manufacturer. Minimum density shall be 2.00 pounds per cubic foot. Use no asphalt or bitumen-impregnated fiber with sealants.

D. Joint Cleaner: Recommended by sealant or caulking compound manufacturer.

E. Bond Breaker: Either polyethylene film or plastic tape as recommended by the sealant manufacturer.

F. Color: Where manufacturer's standard colors do not closely match materials being sealed, provide a custom color.

PART 3 -- EXECUTION

3.01 QUALITY CONTROL

A. Coordinate work with details shown on approved shop drawings prepared by other trades.

B. Verify conditions in the field.

C. Schedule work to follow closely the installation of other trades.

D. Apply sealants and related items in temperatures and dry conditions recommended by the manufacturers.

E. Do not paint sealant, unless recommended by sealant and paint manufacturer.

3.02 PREPARATION

A. Protect finished surfaces adjoining by using masking tape or other suitable materials.

B. Clean and prime joints before starting any caulking or sealing work.

C. Thoroughly clean joints and spaces of mortar and other foreign materials. Cleaning agent shall be Xylol or similar non-contaminating solvent to remove any film from metal surfaces. Masonry or concrete surfaces shall be brushed or air jet cleaned.

D. Joint Requirements

1. All joints and spaces to be sealed in exterior work shall be less than 1/2 inch deep and not less than 1/4 inch wide. If joints in masonry are less than that specified herein, the mortar shall be cut out to the required width and depth. All joints and spaces to receive sealant shall be completely prepared and thoroughly dry before installation of sealant.

2. Unless otherwise specified, joints and spaces which are open to a depth of 1/2 inch or greater shall be solidly filled with back-up material to within 1/4 inch of the surface. Back-up material shall be packed tightly and made continuous throughout the length of the joints. Bond breaker shall be applied as required. If joints are less than 1/4 inch deep, the back-up material may be omitted, a bond breaker substituted and the joint completely filled with sealant. The back-up material shall not project beyond the 1/4 inch depth of the open space in any joint. The following width-to-depth ratio table shall be adhered to, unless otherwise recommended by manufacturer.

	Sealant Depth	
Joint Width	Minimum	Maximum
1/4 inch	1/4 inch	1/4 inch
Over 1/4 inch to 1/2 inch	1/4 inch	Equal to width
Over 1/2 inch to 1 inch	1/2 inch	Equal to width
Over 1 inch to 2 inch	1/2 inch	1/2 of width

3.03 APPLICATION

A. Exercise care before, during, and after installation so as not to damage any material by tearing or puncturing. All finished work shall be approved before covering with any other material or construction.

B. Apply sealant by an approved type of gun except where the use of a gun is not practicable, suitable hand tools shall be used. Avoid applying the compound to any surface outside of the joints or spaces to be sealed. Mask areas where required to prevent overlapping of sealant.

C. All joints shall be waterproof and weathertight.

D. Point sealed joints to make a slightly concave joint, the edges of which are flush with the surrounding surfaces. Exposed joints in the interior side of the door and other frames shall be neatly pointed flush or to match adjacent jointing work.

E. Adjacent materials which have been soiled shall be cleaned immediately and the work left in neat and clean condition.

F. Comply with sealant manufacturer's written instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.

3.04 ADJUSTMENT AND CLEANING

A. Remove misplaced sealant compounds promptly using methods and materials recommended by the manufacturer, as the work progresses.

B. Allow sealants to cure and remove protective edging, of doors, louvers, saddles windows etc. as directed by the Engineer.

3.05 SCHEDULE

Schedule of Sealants

Application	**Sealant**	**Color**
Vertical and horizontal expansion and construction joints in concrete structures unless noted otherwise herein or on Drawings.	Type 1	To closely match adjacent surfaces or mortar and as selected by the Owner.
Vertical and horizontal joints bordered on both sides by masonry, precast concrete, natural stone or other porous building material, unless noted otherwise herein or on Drawings.	Type 2	To closely match adjacent surfaces or mortar and as selected by the Owner.
Vertical and horizontal joints bordered on both sides by painted metals, anodized aluminum, mill finished aluminum, PVC, glass or other non-porous building material.	Type 3	To closely match adjacent surfaces and as selected by the Owner.
Masonry expansion and control joints less than 1¼" wide.	Type 2	To closely match adjacent surfaces and as selected by the Owner.
Masonry expansion and control joints equal or greater than 1¼ inches wide and not to exceed 2".	Type 1	To closely match adjacent surfaces and as selected by the Owner.
Interior – wood trim and finish joints.	Type 5	Color to be selected by Owner
Sanitary areas, joints in ceramic tile, around plumbing fixtures, countertops, and back splashes. See Note 1.	Type 4	To closely match adjacent surfaces and as selected by the Owner.
Perimeter sealing of doors, windows, louvers, piping, ducts, and electrical conduit. See Note 2.	Type 2 OR Type 3	To closely match adjacent surfaces and as selected by the Owner.
Below thresholds.	Type 6	Manufacturer's standard

Application	Sealant	Color
Submerged in liquids. See Note 4.	Type 1	Manufacturer's standard
Horizontal Joints exposed to vehicular or pedestrian traffic.	Type 8	To closely match adjacent surfaces.
Other joints indicated on the drawings or customarily sealed but not listed.	Type recommended by manufacturer	To closely match adjacent surfaces and as selected by the Owner.

Note 1. Sealant for Laboratory Countertop shall be as recommended by countertop manufacturer.

Note 2. Provide UL approved sealants for penetrations thru fire-rated walls.

Note 3. Sealants which will come in contact with potable water shall meet the requirements of NSF 61.

Note 4. Where sealant will be immersed in liquid chemicals verify compatibility prior to installation of sealant.

- END OF SECTION -

DIVISION 08

OPENINGS

SECTION 08 11 13
STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Standard hollow metal doors and frames.
   2. Hinged Transom and frames.

B. Related Sections
   1. Section 04 22 00 - Unit Masonry Assemblies, for embedding anchors for hollow metal work into masonry construction.
   2. Section 08 71 00 - Door Hardware, for door hardware for hollow metal doors.
   3. Section 09 90 00 - Painting and Protective Coatings, for field painting hollow metal doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, and finishes.

B. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings, removable stops, and glazing.
   9. Details of conduit and preparations for power, signal, and control systems.
   10. Details of transom.

11. Details of glazing, glazing frames and stops showing glazing.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification:
   1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
   2. For the following items, prepared on Samples about 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:
      a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
      b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow metal panels and glazing if applicable.

E. Other Action Submittals:
   1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Pre-installation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non vented plastic.
   1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
   1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Amweld Building Products, LLC.
   2. Benchmark; a division of Therma-Tru Corporation.
   3. Ceco Door Products; an Assa Abloy Group company.
   4. Curries Company; an Assa Abloy Group company.
   5. Deansteel Manufacturing Company, Inc.
   6. Firedoor Corporation.
   7. Fleming Door Products Ltd.; an Assa Abloy Group company.
   8. Habersham Metal Products Company.
   9. Karpen Steel Custom Doors & Frames.
   10. Kewanee Corporation (The).
   11. Mesker Door Inc.
   12. Pioneer Industries, Inc.
   13. Security Metal Products Corp.
   14. Steelcraft; an Ingersoll-Rand company.
   15. Windsor Republic Doors.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

J. Glazing:
1. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacturer, fabrication or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
2. Delegated Design: Design glass, including comprehensive engineering analysis according to ICC's 2006 International Building Code by a qualified professional engineer.
3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
   a. Temperature Change: 120 deg F (67 deg C), ambient; material surfaces.
4. Sealants and accessories shall be manufacturer's standards.

2.3 STANDARD HOLLOW METAL DOORS AND HINGED TRANSOM

A. General: Provide doors and hinged transom of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
   a. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 12.3 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
      1). Locations: All doors.

3. Vertical Edges for Single-Acting Doors: Beveled edge.
   a. Beveled Edge: 1/8 inch in 2 inches.
4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.
5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. All Doors and hinged transom: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. All Frames: Fabricated from metallic-coated steel sheet.
1. Fabricate frames with mitered or coped corners.
2. Frames for Level 3 Steel Doors: 0.053-inch- thick steel sheet.

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 STOPS AND MOLDINGS

A. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

2.8 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors and hinged transom:
   1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   2. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
   2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
   4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
   5. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
         1) Two anchors per jamb up to 60 inches high.

2) Three anchors per jamb from 60 to 90 inches high.
3) Four anchors per jamb from 90 to 120 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
1) Three anchors per jamb up to 60 inches high.
2) Four anchors per jamb from 60 to 90 inches high.
3) Five anchors per jamb from 90 to 96 inches high.

c. Compression Type: Not less than two anchors in each jamb.

d. Post-installed Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 08 71 00 - Door Hardware.
1. Reinforce doors, hinged transom and frames to receive non-templated, mortised and surface-mounted door hardware.
2. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
2. Provide loose stops and moldings on inside of hollow metal work.
3. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.9 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pre-treating.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

B. Factory-Applied Paint Finish: Manufacturer's standard, complying with ANSI/SDI A 250.3 for performance and acceptance criteria.
1. Color and Gloss: As selected by Owner or Engineer from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A 250.11.
   1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint

continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

b. Install door silencers in frames before grouting.

c. Remove temporary braces necessary for installation only after frames have been properly set and secured.

d. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

e. Field apply bituminous coating to backs of frames that are filled with grout containing anti-freezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

a. Floor anchors may be set with powder-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.

4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

5. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

6. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

7. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors and Hinged Transom: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.

b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.

c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.

d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and

replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

3.5 SCHEDULE

A. DOOR SCHEDULE – As shown on the Drawings.

END OF SECTION

SECTION 08 31 00
ALUMINUM HATCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Aluminum hatches.
   1. Aluminum hatches shall be supplied as shown on the Drawings.
      a. The aluminum hatches specified herein shall be either single-leaf or double-leaf hatches as indicated on the Drawings.
      b. The single-leaf or double-leaf aluminum hatches shall be housed in either a gutter-type or gutterless-type frame as indicated by the Drawings.
      c. All aluminum hatches shall be a flush-type.
   2. Aluminum hatch opening sizes, number and swing direction of leaves, and locations, shall be as indicated on the Drawings.
   3. Furnish all equipment as shown on the Drawings and as specified herein.
   4. All items furnished by the equipment supplier under this Section are for installation by the Contractor.

1.2 QUALITY ASSURANCE

A. All aluminum hatches furnished under this Section shall be of a design and manufacture that has been used in similar applications and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.

B. Unit Responsibility: Aluminum hatches, complete with frame and all other specified accessories and appurtenances, shall be furnished by the aluminum hatch manufacturer to ensure compatibility and integrity of the individual components and provide the specified warranty for all components.

C. The aluminum hatches specified in this Section, complete with frame and all other specified accessories and appurtenances, shall be furnished by and be the product of one manufacturer.

1.3 SUBMITTALS

A. Submit information to establish compliance with the Specifications in accordance with the provisions of Section 01 33 00 SUBMITTAL PROCEDURES.

B. Submit aluminum hatch location, identification number and specification number.

C. Submit drawing plan and cross sections of equipment.

D. Materials and manufacturing specifications.

E. Equipment booklet including:
   1. Descriptive literature and bulletins.
   2. Customer contact list with telephone numbers (minimum of 10 contacts from similar size facility)

F. Detailed list of any exceptions taken to these Specifications. Include specification reference and proposed alternative with reason stated for exception.

1.4 ALUMINUM HATCH DESIGN

A. Aluminum hatches specified in this Section shall be designed for a 300 psf live load.

B. Aluminum hatches specified as gutter-type shall be designed to be watertight when a 2 inch head of water is present over the hatch.

C. Aluminum hatches shall be designed to open a minimum of 90 degrees.

D. Aluminum hatches shall be designed for easy opening from both inside and outside.

E. Unless otherwise indicated, hinges shall be located on the longer dimension side.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Experience in design and manufacture of aluminum hatches is required for this project. Submit references for a minimum of ten installations of similar design as specified, having yielded successful performance for a period of not less than five years. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
   1. Bilco
   2. Syracuse Castings
   3. Thompson Fabricating
   4. Halliday

2.2 MATERIALS

A. Hatches shall be fabricated from aluminum 6061-T6, unless otherwise indicated. Aluminum hatch hardware shall be Type 316 stainless steel, unless otherwise indicated.

B. Cover Leafs: Shall be 1/4 inch 5086 aluminum checkered plate reinforced with structural aluminum channels capable of withstanding a 300 psf uniform live load with minimal deflection.

C. Hardware: Cover shall be equipped with the following features: Gas spring assist, heavy-duty hinges, tamperproof attaching hardware, automatic hold-open arm with latch.

1. Gas Spring Assist: Type 316 stainless steel.
2. Hold-Open Arm with Aluminum Release Handle: Type 316 stainless steel. Shall automatically lock in the open 90° position. Hold-Open arm shall be fastened to the frame with a 1/2" 316 stainless steel bolt.
3. Heavy-Duty Hinges: Type 316 stainless steel. Each hinge shall have a grade 316 stainless steel 3/8" diameter hinge pin. Hinge shall be fastened to angle and diamond plate with 316 stainless steel bolts and ny-lock nuts.
4. All fasteners which penetrate into the dry area of the hatch shall be sealed with "O" ring seals to prevent incidental leakage.

D. The gutter-type frame shall be 1/4 inch aluminum channel with continuous anchor flange and shall incorporate a neoprene gasket between the frame and the cover leaf when in the closed position. The gutter-type frame shall be provided with a 1 ½ inches threaded drainage coupling located on the Drawings.

E. The gutterless-type frame shall be 1/4 inch aluminum angle with continuous anchor flange and shall incorporate a neoprene gasket between the frame and the cover leaf when in the closed position.

F. Frame Coating: The portion of the frame in contact with concrete shall receive a protective bituminous coating.

G. Locking system: type 316 stainless steel slam lock with one "T" wrench provided per unit.

H. Built-in neoprene gasket shall reduce air leakage to less than 1 cfm per linear foot of frame when the interior of the hatch is subjected to a 2 inch water column vacuum.

I. All double-leaf hatches shall have two interconnected slam locks which latch at both ends of the plate and can be unlatched from a single point.

J. Units shall be supplied with hinged safety grates to provide protection against fall through and to control access to the confined space.

K. Each hatch shall be equipped with an aluminum lift handle. The lift handle shall be flush with the top of the 1/4" diamond plate.

PART 3 - EXECUTION

3.1 INSTALLATION PROCEDURE

A. Follow equipment manufacturer's recommendations for equipment installation and as follows.

B. Fasteners and Anchors to Concrete
1. Expansion and wedge anchors shall not be allowed.
2. All fasteners and anchors which are not integrally cast within the concrete shall be adhesive anchor systems.

3. Adhesive Anchor System: A hybrid adhesive mortar used in conjunction with threaded steel rods or deformed steel reinforcement bars. The adhesive shall be a manufactured product combining urethane methacrylate resin, hardener, Portland cement and water.
   Design Requirements: Adhesive anchors shall be designed based upon the More stringent of the manufacturer's recommendation or the International Council of Building Officials Evaluation Service Report, as applicable.
   a. Available Products
      1). Hilti HIT HY-150 by Hilti Corporation for concrete and grout filled CMU.
      2). Or approved equal.
4. Material for Anchor Rods/Bolts: Alloy Group 2 (A4) (316) stainless steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594. Alloy Group 2 (A4) (316) flat washers, as required.

C. All threads on stainless steel rods/bolts shall be protected with an anti-seize lubricant suitable for submerged stainless bolts and complying with Federal Specification MILl-A-907E.

3.2 WARRANTY

A. Warrant all parts to be free from defects in materials and workmanship for a period of five years after Substantial Completion.

B. Furnish replacement parts to the Owner for any items found to be defective within the five-year warranty period.

END OF SECTION

SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Insulated service doors.

B. Related Sections:

   1. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
      a. Section 05 50 00 - Metal Fabrications, for miscellaneous steel supports.
      b. Section 09 90 00 - Painting and Protection Coatings, for finish painting of factory-primed doors.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
   1. Wind Loads: Uniform pressure (velocity pressure) of 25 lbf/sq. ft., acting inward and outward.
      a. Basic Wind Speed: 90 mph.
      b. Importance Factor: 1.15.
      c. Exposure Category: 6.
   2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

C. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

D. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
   2. Seismic Component Importance Factor: 1.5.
   3. For additional seismic design criteria required for analysis, refer to the plans and spec section 01 81 02.

E. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.3 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
   1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Show locations of replaceable fusible links.
   3. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
   1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Bottom Bar: 6 inches long.
   2. Guides: 6 inches long.
   3. Brackets: 6 inches square.
   4. Hood: 6 inches square.
   5. Laminate-Clad Counter Panel Product: 6 inches square; for each type, color, pattern, and surface finish; laminated to core.

E. Delegated-Design Submittal: For overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Detail fabrication and assembly of seismic restraints.
   2. Summary of forces and loads on walls and jambs.

F. Qualification Data: For qualified Installer.

G. Seismic Qualification Certificates: For overhead coiling doors**,** accessories, and components, from manufacturer.

H. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
   1. Obtain operators and controls from overhead coiling door manufacturer.

PART 2 - PRODUCTS

2.1 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
   1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch and as required to meet requirements.
   2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.
   3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
   4. Gasket Seal: Provide insulated slats with manufacturer's standard interior-to-exterior thermal break or with continuous gaskets between slats.

B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.

D. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent over travel of curtain, and a continuous bar for holding windlocks.
   1. Removable Posts and Jamb Guides for Counter Doors: Manufacturer's standard.

2.2 HOOD

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
   1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.

2.3 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
   1. Lock Cylinders: Provide cylinders standard with manufacturer and keyed to building keying system.
   2. Keys: Provide five for each cylinder.

C. Chain Lock Keeper: Suitable for padlock.

2.4 CURTAIN ACCESSORIES

A. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
   1. At door head, use 1/8-inch- thick, replaceable, continuous sheet secured to inside of hood.
   2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.

2.5 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.6 MANUAL DOOR OPERATORS

A. Equip door with manufacturer's recommended manual door operator unless another type of door operator is indicated.

B. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25 lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

2.7 DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. ACME Rolling Doors.
      b. Alpine Overhead Doors, Inc.
      c. AlumaTek, Inc.
      d. C.H.I. Overhead Doors.
      e. City-Gates.
      f. Cookson Company.
      g. Cornell Iron Works, Inc.
      h. Dynamic Closures Corp.
      i. Lawrence Roll-Up Doors, Inc.
      j. Mahon Door Corporation.
      k. McKeon Rolling Steel Door Company, Inc.
      l. Metro Door.
      m. Overhead Door Corporation.
      n. QMI Security Solutions.
      o. Raynor.
      p. Southwestern Steel Rolling Door Co.
      q. Wayne-Dalton Corp.
      r. Windsor Door.

B. Operation Cycles: Not less than 50,000.
   1. Include tamperproof cycle counter.

C. Curtain R-Value: 6.0 deg F x h x sq. ft./Btu.

D. Door Curtain Material: Galvanized steel.

E. Door Curtain Slats: Flat profile slats of 1-7/8 inch to 3-1/4 inch center-to-center height.

F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

G. Hood: Galvanized steel.
   1. Shape: Round.
   2. Mounting: Face of wall.

H. Locking Devices: Equip door with locking device assembly and chain lock keeper.
   1. Locking Device Assembly: Single-jamb side locking bars, operable from outside with cylinder.

I. Manual Door Operator: Chain-hoist operator.

J. Door Finish:
   1. Baked-Enamel or Powder-Coated Finish: Color as selected by Owner or Engineer from manufacturer's full range.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Perform installation and startup checks according to manufacturer's written instructions.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide weathertight fit around entire perimeter.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

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SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Commercial door hardware for the following: Swinging Doors and Hinged metal transom.

B. Related Sections:
   1. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
   1. Thresholds and weather stripping for locks specified in other Sections.

1.2 SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: For each finish, color, and texture required for each type of door hardware indicated.

C. Samples for Verification: Submit minimum 2-by-4-inch plate Samples of each type of finish required, except primed finish.

D. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

E. Warranty: Special warranty specified in this Section.

F. Other Action Submittals:
   1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
      1) Identification number, location, hand, fire rating and material of each door and frame.
      2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.

3) Complete designations of every item required for each door or opening including name and manufacturer.
4) Fastenings and other pertinent information.
5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
6) Explanation of abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for door hardware.
8) Door and frame sizes and materials.
9) List of related door devices specified in other Sections for each door and frame.

2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations. ***Owner will provide template key to Contractor for Contractor to key all locks.***

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.
1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Engineer, and Owner about door hardware and keying.
2. Installer shall have warehousing facilities in Project's vicinity.
3. Scheduling Responsibility: Preparation of door hardware and keying schedules.

B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

D. Pre-installation Conference: Conduct conference at Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.5 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Three years from date of Substantial Completion.

1.7 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
   2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.

C. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified unless noted otherwise in the hardware schedules.

2.2 HINGES, GENERAL

A. Quantity: Provide the following, unless otherwise indicated:
   1. Two Hinges: For doors with heights up to 60 inches.
   2. Three Hinges: For doors with heights 61 to 90 inches.

B. Template Requirements: Provide only template-produced units.

C. Hinge Weight: Unless otherwise indicated, provide the following:
   1. Exterior Doors and interior metal doors: Heavy-weight hinges.

D. Hinge Base Metal: Unless otherwise indicated, provide the following:
   1. Exterior Hinges: Stainless steel, with stainless-steel pin (630/US32D).
   2. Interior Hinges: Stainless steel, with stainless-steel pin (630/US32D).

E. Hinge Size: 4-1/2-inch x 4-1/2-inch, unless otherwise noted.
   1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors.
   2. Corners: Square.

F. Fasteners: Comply with the following:
   1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
   2. Screws: Phillips flat-head. Finish screw heads to match surface of hinges.

2.3 HINGES

A. Butts and Hinges: BHMA A156.1. Listed under Category A in BHMA's "Certified Product Directory."

B. Template Hinge Dimensions: BHMA A156.7.

C. Available Manufacturers:
   1. Hager Companies (HAG).
   2. Lawrence Brothers, Inc. (LB).
   3. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

2.4 LOCKS AND LATCHES, GENERAL

A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and ANSI A117.1.
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Lock Trim
   1. Levers: Cast.
   2. Escutcheons: Forged or Cast.

   3. Lockset Designs: Provide lockset design(s) indicated by hardware sets or, if locksets are provided by another manufacturer, provide designs that match those designated.

D. Lock Throw: Comply with testing requirements for lengths of bolts required for labeled fire doors, and as follows:
   1. Deadbolts: Minimum 1-inch bolt throw.

E. Backset: 2-3/4 inches, unless otherwise indicated.

F. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:

2.5 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
   1. Bored (Cylindrical) Locks: BHMA A156.2.

B. Bored (Cylindrical) Locks: BHMA A156.2, Grade 1, Series 4000.
   1. Available Manufacturers:
   2. Product Reference Standard: CR CL3100 Series with Armstrong (630) Trim.

2.6 AUXILIARY LOCKS AND LATCHES

A. Auxiliary Locks: BHMA A156.5, Grade 1.

2.7 LOCK CYLINDERS

A. Owner will provide a template key to Contractor for all key locks.

B. Standard Lock Cylinders: BHMA A156.5, Grade 1.
   1. Key Control Level: Category A.
   2. Destructive Test Level: Category A.
   3. Surreptitious Entry Resistance Level: Category A.
   4. Finish: 626/US26D

C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

D. Construction Keying: Comply with the following:
   1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

E. Available Manufacturers
   1. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company.
   2. Or Approved Equal.

2.8 CLOSERS

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and ANSI A117.1.

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.

C. Overhead Closers: Closers shall have high-strength cast-iron body with rectangular covers, adjustable spring power and back-check, and full rack and pinion action. All closers shall have adjustable back-check intensity valves and separate adjustment screws for closing and latching speeds.
   1. Closers for doors over 7-feet in height, or more than 3-feet wide, shall have heavy duty arms.
   2. Closers at exterior doors shall include hold open arms unless otherwise indicated.
   3. Door closer covers and arms shall be primed and painted to match door hardware.
   4. Closers shall be provided with sex bolts for fastening through doors, frames and transoms.

D. Size of Units: Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

E. Surface Closers: BHMA A156.4, Grade 1. Listed under Category C in BHMA's "Certified Product Directory." Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.

F. Closer Design/Type: Closer type as follows:
   1. Regular Arm: Corbin Russwin DC3200 Series
   2. Parallel Arm: Corbin Russwin DC3210 Series
   3. Parallel Arm with Hold Open: Corbin Russwin DC3210

2.9 PROTECTIVE DOOR PLATES

A. Size: 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified below.

B. Fasteners: Manufacturer's standard machine or self-tapping screws.

C. Metal Protective Kick Plates: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:
   1. Material: 0.050-inch- (1.3 mm) thick stainless steel.
   2. Product References Standard: Rockwood No. 1050; 16 inches high.

2.10 STOPS AND HOLDERS

A. Stops and Bumpers: General: BHMA A156.16, Grade 1.
   1. Provide wall stops for doors unless other type stops are scheduled or indicated. Do not mount floor stops were they will impede pedestrian or vehicular traffic. Where floor or wall stops are not appropriate, provide overhead holders.

B. Door Stops: Door stops shall be of the type specified in the hardware sets or in this schedule, and shall be provided with the proper fasteners.
   1. Door Stop Schedule

	Floor Stop w/ Keeper	Floor Stop	Wall Stop w/ Keeper	Wall Stop	Kick Stop (4" Arm)
Rockwood	472	471	476	406	461L

   2. Fasteners/Anchors: Stops shall be provided with machine screws and anchors at concrete and masonry conditions, and toggle bolts at plaster, gypsum board, and wood conditions.

2.11 THRESHOLDS

A. Standard: BHMA A156.21. Listed under Category J in BHMA's "Certified Product Directory."

B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and ANSI A117.1.
   1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2-inch.

C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2-inch high.

D. Threshold Design: All exterior doors shall receive a panic style (offset) aluminum threshold unless otherwise indicated:

1. Accessible Entry: National Guard No. 896N (neoprene gasket).
2. Non-Accessible Entry: National Guard No. 884N (neoprene gasket).
3. Receiving Entry: National Guard No. 513, Saddle/flat style threshold.

2.12 MISCELLANEOUS DOOR HARDWARE/ACCESSORIES

A. Drip Strip: National Guard No. 16A x door width plus 2 inches. Mount head to door frame.

B. Bottom Sweep: National Guard No. 201NA x door width.

C. Weatherstrip: National Guard No. 135N; install at each jamb and at head.

D. Closers: As specified in Section 2.11.

E. Kick/Armor Plates: As specified in Section 2.12.

F. Threshold: As specified in Section 2.14.

2.13 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A.
   1. Existing System: Master key locks to Owner's existing system.

B. Keys: Nickel silver.
   1. Quantity: Five

2.14 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location.
   1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

2.15 FINISHES

A. Standard: BHMA A156.18, as indicated in door hardware sets.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable temporary protective cover before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, wall and floor construction, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.
   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Thresholds: Set thresholds for exterior doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

END OF SECTION

DIVISION 09

FINISHES

SECTION 09 66 01
MONOLITHIC LINING OF MANHOLES AND PUMP STATION WET WELLS

PART 1 GENERAL

1.01 SUMMARY

A. To provide protection from hydrogen sulfide induced corrosion, a monolithic lining shall be applied:

1. To all pump station wet wells.
2. New and/or existing manholes where a new force main will discharge
3. All manholes with inside or outside drops.
4. All manholes that receive flow from a main sewer at a slope greater than 10 percent.
5. Manholes and other structures where the Owner/Owners Representative has determined that turbulence may result in the release of hydrogen sulfide.

B. This Specification addresses sealing of existing structures that have inflow and infiltration or have been damaged by hydrogen sulfide induced corrosion. Where new structures show signs of inflow and infiltration they shall be replaced and/or repaired in accordance with the direction of the Owner/Owners Representative.

1.02 SECTION INCLUDES

A. The materials and application of a corrosion-resistant, spray- or roller-applied, monolithic lining system.

1.03 QUALITY ASSURANCE

A. Applicator's Experience: Minimum 3 years of practical experience in the application of specified products.

B. Qualification of Contractor's Personnel:

1. Underlayment Trowel Applicators:
   a. Demonstrated capability of troweling underlayment in a manner that yields a strong, uniform, well-bonded substrate for lining application as specified herein, subject to the Owner/Owners Representative, Engineer/Designer and Manufacturer's approval prior to start of underlayment application.

b. Minimum of 3 years' continuous experience on similar type trowel underlayment projects.
c. Shall be certified/trained by the underlayment manufacturer.

2. Lining Spray Applicators:
   a. Demonstrated capability of applying lining material in a manner that yields a strong, uniform thickness, well-bonded, pin-hole free coating as specified herein, subject to the Owner/Owners Representative, Engineer/Designer and Manufacturer's approval prior to start of lining application.
   b. Minimum 3 years' continuous experience on similar type plural component lining projects.
   c. Shall be certified/trained by the lining manufacturer.

1.04 WARRANTY

A. Material Warranty: A written guarantee of 5-year shall be provided by the manufacturer against any breakdown of the material effectiveness of the structural repair elements.

B. Workmanship Warranty: A written guarantee of 5-year minimum shall be provided by the Contractor against any shortcomings of the workmanship.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver lining products to the Project Site in unopened containers that plainly show, at time of use, the designated name, date of manufacture, batch number, and name of manufacturer.

B. Store lining products in a suitable protected area that is heated or cooled as required to maintain temperatures within the range recommended by lining manufacturer.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:

1. Provide bypass pumping as required.
2. Control the environment within the facility that is to be lined. This includes maintaining the required application temperature and humidity for the linings being applied.
3. Provide illumination for surface preparation and application and curing of all underlayment and lining materials.
4. Provide equipment to ventilate the facilities during the application and cure of the lining materials.

1.07 SEQUENCING AND SCHEDULING

A. Lining shall not be applied until new concrete has reached its 28-day strength unless otherwise approved by the manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Lining and underlayment materials shall have a documented, proven performance record in similar facilities and exposure conditions.

B. Manufacturers shall be regularly engaged in the production of such materials for identical service conditions and have a minimum of 5 years' verifiable experience in manufacture of these products. The following manufacturer's products that have been approved by the Owner/Owners Representative are acceptable:

1. Urethane Resin Liner:

   Spray Wall
   Sprayroq, Inc.
   4707 Alton Court
   Birmingham, AL 35210
   Contact: Mr. Brad Bell
   Telephone: (205) 957-0020

2. Multi-Component Stress Skin Panel Liner:

   Spectra-Shield Liner System
   CCI Spectrum, Inc.
   9716 Florida Mining Blvd. W.
   Jacksonville, FL 32257
   Contact: Bob Klopfenstein
   Telephone: (904) 268-4951
   Fax: (904) 268- 4923

3. Cured-In-Place Epoxy Resin Liner:

   Poly-Triplex Liner System
   SunCoast Environmental International, Inc.
   907 Orange Hill Road
   Chipley, Florida 32428
   Contact: Kathy Jones
   Telephone: (800) 395-4637

4. Sprayed Applied Epoxy Resin Liner:

   Raven 405
   Reynolds, Inc.
   5120 Selkirk Drive, STE 140
   Birmingham, Alabama 35242
   Contact: Mr. Ken Thompson
   Telephone: (205) 408-5949
   Fax: (205) 408-5907

   Warren Environmental System M-201 and S-301
   Warren Environmental, Inc.
   P.O. Box 125
   South Carver, MA 02330
   Contact: Danny Warren
   Telephone: (508) 866-5721

5. Fiberglass Insert:

   L.F. Manufacturing Fiberglass Insert
   R.E. Inman & Associates, Inc.
   2910-M Cole Court
   Norcross, GA 30071
   Contact: Mr. Robert E. Inman
   Telephone: (770) 446-5656

6. Fiberglass Reinforced Epoxy Resin Liner:

   PerpetuWall Protective Liner Systems
   261 Douglas Road East
   Oldsmar, FL. 34677
   Contact: Mr. Jerry Trevino
   Telephone: (813) 855-6550

2.02 TEST EQUIPMENT

A. Before construction begins, the Contractor shall obtain and be knowledgeable in the use of the following equipment:

   1. U.S. Weather Bureau Psychometric Tables for determining dew point from wet and dry bulb temperatures, as available from KTA-Tator, Inc., Pittsburgh, PA.
   2. A portable, self-contained, hand-held sling psychrometer with thermometers ranging from 20 degrees F to 120 degrees F and built-in slide rule for determination of relative humidity as manufactured by Bacharach instrument Co., Pittsburgh, PA; or Taylor Co.

3. A hand-held digital thermometer, range minus 20 degrees F to 200 degrees F, and interchangeable surface temperature and air temperature probes as manufactured by Atkins.
4. A high voltage holiday detector for thick film coatings as manufactured by Tinker and Razor, Model AP/W, San Gabriel, CA.
5. Ten hand-held pH pencils suitable for measuring pH of concrete surfaces as manufactured by Burrel Scientific, Model Insta-Check Surface pH pencil, No. P-13N, Pittsburgh, PA.

B. This test equipment shall be used for monitoring and testing requirements.

C. The test equipment shall be stored at the Project Site for the Contractor's daily use and shall be maintained in accurate, working conditions at all times. The test equipment shall be available to the Owner/Owners Representative for testing purposes.

2.03 CHEMICAL PRESSURE GROUTING SYSTEMS

A. Where the pressurized injection of chemical grout behind the manhole chimney and joints is required to control and eliminate inflow or infiltration, the material supplied shall be a urethane gel or polyurethane resin with properties as follows:

1. While being injected, the chemical sealant must be able to react/perform in the presence of infiltrating water.
2. The cured sealant must be capable of withstanding submergence in water without degradation.
3. The cured sealant must prevent the passage of water through the manhole defect.
4. The cured sealant must be flexible as opposed to brittle or rigid.
5. In place, the cured sealant shall be able to withstand freeze/thaw and wet/dry cycles without adversely affecting the seal.
6. The cured sealant must not be biodegradable. Additives may be used to meet this requirement, without affecting long-term strength.
7. The cured sealant shall be chemically stable and resistant to concentrations of acids, alkalis, and organics found in normal sewage.
8. Packaging of component materials must be compatible with field storage and handling requirements. Packaging must provide for worker safety and minimize spillage during handling.

9. In the event that the chemical sealant may be harmful by passing through the unbroken skin, by inhalation of dust, vapor or mist, or by swallowing, the handling and mixing shall be performed with proper equipment, with adequate ventilation, and by personnel thoroughly familiar with the chemicals involved and shall be in strict accordance with the manufacturer's recommendations and with the provisions of all safety regulations.
10. Mixing of component materials must be compatible with field conditions.
11. Residual sealing materials must be easily removable from the bench of manhole to prevent reduction or blockage of the sewer flow.
12. No grouting operations shall be performed at temperatures below 40 degrees F or where the temperature of the groundwater is below 40 degrees F.
13. Urethane gel grout or Polyurethane resin grout shall be utilized for the entire manhole.
14. Urethane Gel: Urethane gel shall have the following properties and characteristics:
    a. One part urethane prepolymer thoroughly mixed with between 5 and 10 parts water by weight. The recommended mix ratio is 1 part urethane prepolymer to 8 parts of water (11 percent prepolymer).
    b. A liquid prepolymer having a solids content by weight of 77 percent to 83 percent, specific gravity of 1.04 (8.65 pounds per gallon), and flash point of 200 degrees F.
    c. A liquid prepolymer having a viscosity of 600 to 1,200 centipoise at 70 degrees F, that can be pumped through 500 feet of 1/2-inch hose with a 1,000 psi head at a 1-ounce per second flow rate.
    d. The water used to react the prepolymer should be in the pH range of 6.5 to 8.0.
    e. A cure time of 80 seconds at 40 degrees F, 55 seconds at 60 degrees F, and 30 seconds at 80 degrees F, when 1 part prepolymer is reacted with 8 parts of water only. Higher water ratios give longer cure times.
    f. A cure time that can be reduced to 10 seconds for water temperatures of 40 degrees F to 80 degrees F when 1 part prepolymer is reacted with 8 parts water containing gel control agent.
    g. A relative rapid viscosity increase of the prepolymer/water mix. Viscosity increases from about 10 to 60 centipoise in the first minute for 1 to 8 prepolymer/water ratio at 50 degrees F.
    h. A reaction (curing) which produces a chemically stable, non-biodegradable, tough, flexible gel.

i. The ability to increase mix viscosity, density, gel strength and resistance to shrinkage by using additives in the water component of the grout.
j. The ability to accept suspended additives such as two, 6-dichlorobenzonitrile root control.
k. Contain a minimum of 15 percent shrink control agent supplied by the same manufacturer.

15. Polyurethane Resin Grout: Polyurethane resin grout shall have the following properties and characteristics:
a. Viscosity: 120 – 350 cps.
b. Weight Per Gallon: 8.65 to 9.48 lbs./gal.
c. Solids Content: 88 percent to 100 percent (ASTM D2834).
d. Induction Time: 3 to 4 minutes.
e. Cure Time: 5 to 6 minutes.
f. Tensile Strength: 40 to 450 psi (ASTM D3574).
g. Elongation: 3 percent to 350 percent (ASTM D3574).
h. Shrinkage: Less than 2 percent (ASTM D1042/D756).
i. Initial Linear Shrinkage: 9 percent.
j. Tear Resistance: 21 lbs./in. (ASTM D3574).
k. Density: 38 to 119 lbs./ft^3 (ASTM D3574).
l. No catalyst required; single component product.

PART 3 EXECUTION

3.01 GENERAL

A. Surface Preparation Inspection:

1. Provide the Owner/Owners Representative Inspector a minimum of 3 days' advance notice prior to start of surface preparation work or coating application work.
2. Perform surface preparation only in presence of Engineer/Designer unless otherwise approved.
3. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed directions and recommendations of the lining manufacturer.
4. The cleaned substrate shall be inspected and approved by the Engineer/Designer and a representative of the manufacturer prior to the application of any underlayment or lining materials.

B. Obtain a full cure of the entire system before the area is placed back in service. Consult lining manufacturer's written instructions for these requirements. Do not immerse lining for any purpose until completion of curing cycle.

C. Contractor shall provide adequate means to prevent concrete debris generated during the surface preparation interfering with the Owner's treatment process or equipment. Water free of sediment and deleterious compounds may be diverted to the Owner's treatment process upon approval by the Owner.

3.02 PREPARATION OF SURFACES

A. Surfaces to receive this lining system shall be free of dust, loose particles, oils, grease, chemical contaminants, attacked concrete, and previously applied protective coatings and have a minimum pH of 10 for concrete surfaces.

B. All surfaces to be lined shall be cleaned by hydroblasting and/or abrasive blasting. Hydroblasting shall be completed using potable water. Only non-silica abrasives shall be used for abrasive blasting. Contractor shall provide provisions to keep material from falling into the sewer.

C. During surface preparation activities, the Contractor shall regularly (approximately every 100 square feet) measure the surface pH using pH test pencils to verify compliance with these Specifications. Surfaces not meeting the requirements shall be marked and reblasted.

D. Following completion of surface preparation, all active hydrostatic leaks shall be plugged by use of a water-stop material. All structural defects, voids, or cracks in the substrate shall be repaired prior to the application of the underlayment or monolithic lining. Repair materials shall be approved by the lining manufacturer.

E. The attacked or rough concrete substrate, including voids, crevices, and holes, shall be resurfaced with the underlayment material to return it to pre-existing levels. Mix and apply underlayment in accordance with the lining manufacturer's written recommendations.

F. If any reinforcing steel is exposed during the surface preparation operation, the Engineer/Designer shall be notified and the reinforcing steel shall be repaired per Engineer/Designer’s instructions. Exposed rebar shall be abrasive blasted (SSPC SP10) and coated with at least 3 mils of epoxy.

G. Mark and protect embedded anchors prior to blasting.

3.03 LINING APPLICATION

A. Mix and apply monolithic lining in accordance with the lining manufacturer's recommendations.

B. The lining thickness will vary by system but shall be a minimum thickness of 125 mils. Follow lining manufacturer's specific recommendations to ensure installation of the minimum thickness and a pinhole free surface.

3.04 MANHOLE CHEMICAL PRESSURE GROUTING

A. General: Pressure grouting shall be done in accordance with the Drawings and will be performed on any sections that have evidence of rain-derived inflow and infiltration. Any structurally unsound manholes observed by Contractor shall be replaced as directed by Engineer/Designer.

1. The existing manhole structure designated for pressure grouting for pipe seals or for precast joints shall be thoroughly cleaned prior to grouting. Contractor shall dispose of all debris and prevent any debris from entering the existing sewer lines.
2. Grade adjustments, frame and cover replacements, chimney repairs, frame seals and other repairs shall be performed prior to pressure grouting. Pressure grouting shall be done prior to interior lining. All roots exposed in the manhole shall be removed.
3. Pressure chemical grouting of the manhole may include chimney and pipe seals.

B. Grouted and Coated Pipe Sealing:

1. Injection holes shall be drilled with a minimum of three holes around the pipe/manhole wall connection. After removal of the grouting probe, activated oakum rope shall be used to fill the injection hole. Injection hole shall be patched with waterproof, quick setting mortar and covered with a moisture resistant two-part epoxy adhesive coating. Any pipe damaged by Contractor while drilling the injection hole shall be replaced.
2. Contractor shall replace any portion of the existing manhole or pipe which is damaged during pipe sealing.
3. The deteriorated area of the pipe seal shall be removed to sound material. Care shall be taken to avoid damaging other parts of the manhole structure. Loose and broken brick, mortar, concrete or debris, and pipe shall be removed from the manhole.
4. A Bonding agent, Weld-Crete as manufactured by Larsen Products Company or approved equal, shall be applied to existing surfaces to provide a firm adhesion between original and new cementitious materials in accordance with manufacturer's recommendation.
5. Contractor shall place rapid-set grout, Octocrete, as manufactured by IPA, or approved equal, to the area. Rapid-set grout shall be placed in such a manner that it is consolidated, fills existing voids, and creates a smooth, dense surface in accordance with the Drawings.

6. Wastewater flow shall be maintained by methods which prevent contact with new pipe seal after Rapid-set grout placement in accordance with manufacturer's recommendations.
7. The pipe seal shall form a water tight seal with the manhole wall, bench, trough, and pipe. The manhole and pipes shall be cleaned of all debris and foreign matter.
8. Contractor is responsible to stop all active inflow and infiltration leaks in the manhole prior to placing the interior coating. Work and materials required to stop leaks in the manhole are considered subsidiary to Interior Chimney Lining and will not be paid for directly.

3.05 TESTING

A. General:

1. Perform testing, document and submit results to the Owner/Owners Representative.
2. Provide the Owner/Owners Representative 24 hours' notice of start of testing.
3. Manufacturer/manufacturer's representative shall be present for testing as required for preparation of proper installation documentation.

B. Air, Concrete Substrate, and Lining Materials:

1. Temperatures:
   a. Measure and record twice daily air, concrete substrate, and lining surface temperatures within structure during mixing, application, and curing of materials; verify compliance with manufacturer's temperature ranges.
   b. Take measurements in morning and afternoon in presence of Engineer.
   c. If outside acceptable range, make adjustments to return to and maintain manufacturer's required temperatures prior to continuing lining application.
2. Humidity:
   a. Measure and record twice daily relative humidity within structure during mixing, application, and curing of materials; verify compliance with manufacturer's requirements.
   b. Take measurements in morning and afternoon in presence of Engineer/Designer.
   c. If outside acceptable range, make adjustments to return to and maintain manufacturer's required relative humidity prior to continuing lining application.

C. Epoxy Lining and Polyurethane/Polymer Lining System:

1. Wet Film Thickness Gauge: During application, use wet film thickness gauge; meet ASTM D4414 to ensure monolithic coating and uniform thickness.
2. Holiday Detection:
    a. In accordance with NACE SPO 188.
    b. After 24 hours minimum, spark test lining system to ensure pinhole-free lining.
    c. Mark defects and repaired per manufacturer's instructions.
3. Adhesion Test:
    a. Test 10 percent minimum of manholes for adhesion/bond of coating to substrate. Engineer/Designer will select manholes to be tested.
    b. Conduct in accordance with ASTM D4542 as modified herein.
        1) Prepare coating and dollies to receive adhesive.
        2) Attach three 20-millimeter dollies minimum. Adhesive used to attach dollies to coating shall be rapid setting with tensile strength in excess of coating product and permitted to cure in accordance with manufacturer's recommendations.
        3) Failure of dolly adhesive shall be deemed a nontest and require retesting.
        4) Prior to performing pull test, score coating to within 30 mils of substrate by mechanical means without disturbing dolly or bond within test area.
        5) Two of the three adhesion pulls shall exceed 200 psi or concrete failure with more than 50 percent of subsurface adhered to coating.
        6) Should a structure fail to achieve two successful pulls as described above, perform additional testing at discretion of Engineer/Designer.
        7) Areas detected to have inadequate bond strength shall be evaluated by Engineer/Designer.
        8) Further bond tests may be performed in area to determine extent of potentially deficient bonded area.
        9) Repairs deficient areas.
4. Vacuum Test: Vacuum test conforming to the requirements of ASTM C1244 shall be performed for every lined manhole unless otherwise approved by the Engineer/Designer.

3.06 MANUFACTURERS' FIELD SERVICES

A. Manufacturer's Authorized Technical Representative: Coordinated by the Contractor and present at the work site for the construction activities indicated below for observation of product application, verification of quality assurance, and to determine compliance with manufacturer's instructions. The minimum person-days are listed below, travel time excluded.

B. Minimum Services at the Start of the Work shall Include:

1. 0.5 person-day for start of surface preparation.
2. 1 person-day for start of underlayment application and lining application.
3. 1 person-day for start of lining spray application.

C. Additional person-days as may be necessary to resolve field problems attributable to or associated with, manufacturer's products furnished under this Contract.

END OF SECTION

SECTION 09 90 00
PAINTING AND PROTECTIVE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Exposed, buried, and submerged metal, exposed PVC and CPVC, exposed FRP, and aluminum and dissimilar metals, to be protective painted, whether specifically mentioned or not, except as specified otherwise. Prime coat structural steel surfaces, as specified herein. Exterior concrete surfaces will not be protective painted except as specified herein. Interior concrete surfaces will be protective painted as specified herein.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American National Standards Institute (ANSI):
      a. Standard Colors for Color Identification and Coding.
      b. A13.1, Scheme for the Identification of Piping Systems.
   2. American Water Works Association (AWWA):
      a. C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines-Enamel and Tape-Hot-Applied.
      b. C210, Liquid Epoxy Coating System for the Interior and Exterior of Steel Water Pipelines.
      c. C214, Tape Coating Systems for the Exterior of Steel Water Pipelines.
   3. NSF International (NSF): 61 Drinking Water System Components-Health Effects.
   4. National Association of Corrosion Engineers (NACE): Manual for Painter Safety.
   5. Occupational Safety and Health Act (OSHA).
   6. Steel Structures Painting Council (SSPC):
      a. QP1, Standard Procedure for Evaluating Qualifications of Painting Contractors.
      b. QP2, Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint.
      c. SP 1, Surface Preparation Specification No. 1, Solvent Cleaning.
      d. SP 2, Hand Tool Cleaning.
      e. SP 3, Power Tool Cleaning.
      f. SP 5, White Metal Blast Cleaning.
      g. SP 6, Commercial Blast Cleaning.
      h. SP 7, Brush-Off Blast Cleaning.
      i. SP 8, Pickling.
      j. SP 10, Near-White Blast Cleaning.
      k. SP 11-T, Power Tool Cleaning to Bare Metal.
      l. Guide No. 3, PA, Guide to Safety in Painting Applications.
      m. SP 13, Surface Preparation of Concrete.

1.3 DEFINITIONS

A. Terms used in this section:
   1. Coverage: Total minimum dry film thickness in mils, or square feet per gallon.
   2. FRP: Fiberglass Reinforced Plastic.
   3. HCl: Hydrochloric Acid.
   4. MDFT: Minimum Dry Film Thickness.
   5. MDFTPC: Minimum Dry Film Thickness per Coat.
   6. Mil: Thousandth of an inch.
   7. Military Specification-Paint.
   8. PSDS: Paint System Data Sheet.
   9. SFPG: Square Feet per Gallon.
   10. SFPGPC: Square Feet per Gallon per Coat.
   11. SP: Surface Preparation.

1.4 SUBMITTALS

A. General: Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

B. Shop Drawings:
   1. Schedule of proposed coating materials.
   2. Schedule of surfaces to be coated with each coating material.

C. Product Data: Include description of physical properties of coatings including solids content and ingredient analysis, VOC content, temperature resistance, typical exposures and limitations, and manufacturer's standard color chips:
   1. Data Sheets:
      a. For each paint system, furnish a Paint System Data Sheet (PSDS), the Manufacturer’s Technical Data Sheets, and paint colors available (where applicable) for each product used in the paint system. The PSDS form is appended to the end of this section.
      b. Submit required information on a system-by-system basis.
      c. Furnish copies of paint system submittals to the coating applicator.
      d. Indiscriminate submittal of Manufacturer’s literature only is not acceptable.
      e. Regulatory requirements: Submit data concerning the following:
      f. Volatile organic compound limitations.
      g. Coatings containing lead compounds and PCBs.
      h. Abrasives and abrasive blast cleaning techniques, and disposal.
      i. NSF certification of coatings for use in potable water supply systems.

D. Samples: Include 8-inch square drawdowns or brush-outs of topcoat finish when requested. Identify each sample as to finish, formula, color name and number and sheen name and gloss units.

E. Certificates: Submit in accordance with requirements for Product Data.

F. Manufacturer's Instructions: Include the following:

1. Special requirements for transportation and storage.
2. Mixing instructions.
3. Shelf life.
4. Pot life of material.
5. Precautions for applications free of defects.
6. Surface preparation.
7. Method of application.
8. Recommended number of coats.
9. Recommended dry film thickness (DFT) of each coat.
10. Recommended total dry film thickness (DFT).
11. Drying time of each coat, including prime coat.
12. Required prime coat.
13. Compatible and non-compatible prime coats.
14. Recommended thinners, when recommended.
15. Limits of ambient conditions during and after application.
16. Time allowed between coats (minimum and maximum).
17. Required protection from sun, wind, and other conditions.
18. Touch-up requirements and limitations.
19. Minimum adhesion of each system submitted in accordance with ASTM D 4541.

G. Manufacturer's Representative’s Field Reports: Submit as specified in Section 01 77 00.

H. Operations and Maintenance Data: Submit as specified in Section 01 77 00 CLOSEOUT PROCEDURES.
1. Reports on visits to project site to view and approve surface preparation of structures to be coated.
2. Reports on visits to project site to observe and approve coating application procedures.
3. Reports on visits to coating plants to observe and approve surface preparation and coating application on items that are “shop coated.”

I. Contract Closeout Submittals: Special guarantee.

1.5 QUALITY ASSURANCE

A. Quality Assurance Submittals:
1. Quality Assurance plan.
2. Qualifications of coating applicator including List of Similar Projects and List of References substantiating experience.
3. Factory Applied Coatings: Manufacturer’s certification stating factory applied coating system meets or exceeds requirements specified.
4. If the Manufacturer of finish coating differs from that of shop primer, provide both Manufacturers’ written confirmation that materials are compatible.
5. Manufacturer’s written instructions and special details for applying each type of paint.
6. Manufacturers’ Certification of Proper Installation.

B. Certifications: All paints and coatings to be used on this project comply with current federal, state, and local VOC regulations

C. Applicator qualifications:
   1. Minimum of 5 years' experience applying specified type or types of coatings under conditions similar to those of the Work:
   2. Provide qualifications of applicator and references listing 5 similar projects completed in the past 2 years.
   3. Manufacturer approved applicator when manufacturer has approved applicator program.
   4. Approved and licensed by polymorphic polyester resin manufacturer to apply polymorphic polyester resin coating system.
   5. Approved and licensed by elastomeric polyurethane (100 percent solids) manufacturer to apply 100 percent solids elastomeric polyurethane system.
   6. Applicator of off-site application of coal tar epoxy shall have successfully applied coal tar epoxy on similar surfaces in material, size, and complexity as on the Project.

D. Regulatory requirements: Comply with governing agencies regulations by using coatings that do not exceed permissible volatile organic compound limits and do not contain lead:
   1. Do not use coal tar epoxy in contact with drinking water or exposed to ultraviolet radiation.
   2. Perform surface preparation and painting in accordance with recommendations of the following:
   3. Paint Manufacturer's instructions.
   4. SSPC-PA Guide No. 3, Guide to Safety in Paint Applications.
   5. Federal, state, and local agencies having jurisdiction.

E. Samples:
   1. Reference Panel:
      a. Prior to start of surface preparation, furnish a 4" by 4" steel panel for each grade of sandblast specified herein, prepared to specified requirements.
      b. Provide panel representative of the steel used; prevent deterioration of surface quality.
      c. Upon approval of Engineer, panel to be reference source for inspection.
      d. Unless otherwise specified, before painting work is started, prepare minimum 8" by 10" samples with type of paint and application specified on similar substrate to which paint is to be applied.
      e. Furnish additional samples as required until colors, finishes, and textures are approved.
      f. Approved samples to be the quality standard for final finishes.
      g. Field samples:
      h. Prepare and coat a minimum 100 square foot area between corners or limits such as control or construction joints of each system.
      i. Approved field sample may be part of Work.
      j. Obtain approval before painting other surfaces.

F. Pre-installation conference: Conduct as specified in Section 01 31 19 PROJECT MEETINGS.

G. Compatibility of coatings: Use products by same manufacturer for prime coats, intermediate coats, and finish coats on same surface, unless specified otherwise.

H. Services of coating manufacturer's representative: Arrange for coating manufacturer's representative to attend pre-installation conferences. Make periodic visits to the project site to provide consultation and inspection services during surface preparation and application of coatings, and to make visits to coating plants to observe and approve surface preparation procedures and coating application of items to be "shop primed and coated".

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products as specified in Section 01 60 00 PRODUCT REQUIREMENTS.

B. Remove unspecified and unapproved paints from Project site immediately.

C. Deliver new unopened containers with labels identifying the manufacturer's name, brand name, product type, batch number, date of manufacturer, expiration date or shelf life, color, and mixing and reducing instructions.
   1. Do not deliver materials aged more than 12 months from manufacturing date.

D. Store coatings in well-ventilated facility that provides protection from the sun, weather, and fire hazards. Maintain ambient storage temperature between 45 and 90 degrees Fahrenheit, unless otherwise recommended by the manufacturer.

E. Take precautions to prevent fire and spontaneous combustion.

F. Shipping:
   1. Where pre-coated items are to be shipped to the site, protect coating from damage. Batten coated items to prevent abrasion.
   2. Use nonmetallic or padded slings and straps in handling.

1.7 PROJECT CONDITIONS

A. Surface moisture contents: Do not coat surfaces that exceed manufacturer specified moisture contents, or when not specified by the manufacturer, the following moisture contents:
   1. Plaster and gypsum wallboard: 12 percent.
   2. Masonry, concrete, and concrete block: 12 percent.
   3. Interior located wood: 15 percent.
   4. Concrete floors: 7 percent.

B. Do not apply coatings:

1. Under dusty conditions or adverse environmental conditions, unless tenting, covers, or other such protection is provided for structures to be coated.
2. When light on surfaces measures less than 15 foot-candles.
3. When ambient or surface temperature is less than 55 degrees Fahrenheit unless manufacturer allows a lower temperature.
4. When relative humidity is higher than 85 percent.
5. When surface temperature is less than 5 degrees Fahrenheit above dew point.
6. When surface temperature exceeds the manufacturer's recommendation.
7. When ambient temperature exceeds 90 degrees Fahrenheit, unless manufacturer allows a higher temperature.
8. Apply clear finishes at minimum 65 degrees Fahrenheit.

C. Provide fans, heating devices, dehumidifiers, or other means recommended by coating manufacturer to prevent formation of condensate or dew on surface of substrate, coating between coats and within curing time following application of last coat.

1.8 SPECIAL GUARANTEE

A. Furnish Manufacturer’s extended guarantee or warranty, with OWNER named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of the OWNER, removal and replacement of work specified in this Specification section found *defective* during a period of 1 year after the date of Substantial Completion.

B. Contractor and paint Manufacturer shall jointly and severally furnish guarantee.

1.9 MAINTENANCE

A. Extra materials: Deliver as specified in Section 01_77_00. Include minimum 1 gallon of each type and color of coating applied:
1. When manufacturer packages material in gallon cans, deliver unopened labeled cans as comes from factory.
2. When manufacturer does not package material in gallon cans, deliver material in new gallon containers, properly sealed and identified with typed labels indicating brand, type, and color.

PART 2 - PRODUCTS

2.1 PAINT AND COATINGS MANUFACTURERS

A. Nationally recognized Manufacturers of paints and protective coatings who are regularly engaged in the production of such materials for essentially identical service conditions.

B. Manufacturers:
1. Tnemec Coatings
2. Induron Coatings
3. Or Approved Equal.

2.2 PROTECTIVE COATINGS SYSTEMS

A. All finish coating colors to be submitted for Owner/Engineer selection and/or approval, as applicable.

B. System No. 1 Submerged Metal- General

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast, or Centrifugal Wheel Blast (SP 10)	Prime: Polyamide Epoxy	1 coat, 6.0 MDFT
	Finish: Modified Polyamine High Build Epoxy	1 coat, 12.0- 15.0 MDFT

C. System No.2 Submerged Metal - Potable Water:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast, NAPF 500-03-04	Prime: NSF-approved Poly-amidoamine epoxy	6 MDFT
	Intermediate: Polyamide High Build Epoxy	1coat 6 MDFT
	Finish: Modified High Build Polyamine Epoxy	1 Coat, 10 MDFT

D. System No. 3 Ductile Iron Pipe – Non Submerged Inside Building:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast, NAPF 500 03-04	Shop Prime: NSF-approved Polyamidoamine epoxy primer	1 coat, 6 MDFT
	Field Prime: Polyamide High Build Epoxy	1 coat; 4 MDFT
	Finish: Aliphatic Acrylic Pol-yurethane Enamel	1 coat, 3 MDFT

E. System No. 4 Ductile Iron Pipe – Non Submerged – Exterior Exposed:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast, NAPF 500 03-04	Shop Primer: NSF ap-proved polyamidoamine epoxy	1 coat, 6 MDFT
	Field Prime: Polyamide High Build Epoxy	1 coat, 5 MDFT
	Finish: Aliphatic Acrylic Pol-yurethane Enamel	1 coat, 3 MDFT

F. System No. 5 Exposed Metal- General:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast, or Centrifugal Wheel Blast (SP 10)	Prime: Moisture Cured Urethane Zinc Rich Primer	1 coat, 2.5 MDFT
	Intermediate: Polyamide High Build Epoxy	1 coat, 3 MDFT
	Finish: Aliphatic Acrylic Polyurethane Enamel	1 coat, 3 MDFT

G. System No. 6 Exposed Metal-High Temperature (150 to 350 degrees Fahrenheit):

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast, or Centrifugal Wheel Blast (SP 10)	Prime: Corrosion inhibitive silicone alkyd primer	1 Coat, 2 MDFT instructions
	Finish: Acrylic Silicone Copolymer	1 Coat, 2 MDFT

H. System No. 7 Buried Metal-General:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast or Centrifugal Wheel. Blast (SP 10)	Prime: Standard Hot Coal-Tar Enamel -OR- Coal-Tar Epoxy -OR- Tape Coat System	AWWA C203 AWWA C210 AWWA C214
	For Acidic Soil, Brackish Water High Bacteria: Hot Coal-Tar, Double Felt	AWWA C203, App. A, Sec. Al.5
	For Highly Abrasive Soil, Brackish Water: Hot Coal-Tar, Fibrous Glass -OR- Tape Coat System	AWWA C203, App. A, Sec. A1.5 AWWA C214 with Double Outer Wrap

I. System No. 8 Galvanized Metal Conditioning:

Surface Prep.	Paint Material	Min. Coats, Cover
SSPC-SP 16	Prime: Polyamide Epoxy Primer	1 coat, 2 MDFT
		Remaining coats as required for exposure

J. System No. 9 Galvanized Metal Repair:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 1) Followed by Hand Tool (SP 2) or Power Tool (SP 3)	Prime: Moisture Cured Urethane Zinc Rich Primer	1 coat, 3 MDFT
		Remaining coats as required for exposure

K. System No. 10 Exposed PVC:

Surface Prep.	Paint Material	Min. Coats, Cover
Scarify	Prime: Polyamide High Build Epoxy	1 coat, 3 MDFT
	Finish: Poly Urethane Enamel	1 coat, 3 MDFT

L. System No. 11 Aluminum and Dissimilar Metal Insulation:

Surface Prep.	Paint Material	Min. Coats. Cover
SSPC-SP 16	Prime: Polyamide Epoxy Primer	1 coat, 2 MDFT
	Finish: Coal Tar Epoxy	1 coat, 16 MDFT

M. System No. 12 Concrete/CMU - Repair:

Surface Prep.	Paint Material	Min. Coats. Cover
SP 13 / ICRI CSP 5	Depth of Repair = ¼" or less: 100% Solids, Epoxy Modified Cementitious Mortar Repair Depth of Repair Greater Than ¼": Hydraulic Cementitious Repair Mortar-Reblast after cure to produce ICRI CSP 5	As required to form a smooth surface profile or as shown on drawings
	Finish: 100% Solids, Fiberglass Reinforced Modified Polyamine Epoxy	1 coat minimum, 120 MDFT

N. System No. 13 New Concrete/CMU- Exterior (as required by application schedule):

Surface Prep.	Paint Material	Min. Coats. Cover
SP 13	Filler: Waterborne Cementitious Acrylic Block Filler	Spray or Roller apply followed by Squeegee. Provide a pinhole free surface
	Intermediate: Waterborne Acrylic Epoxy	1 coat, 4.0 MDFT
	Finish: Ceramic Modified Water Borne Aliphatic Polyurethane Enamel	1 coat, 2 MDFT

O. System 14 Concrete/CMU- Interior:

Surface Prep.	Paint Material	Min. Coats. Cover
SP 13	Filler: Waterborne Cementitious Acrylic Block Filler	Spray or Roller apply followed by Squeegee. Provide a pinhole free surface
	Intermediate: Waterborne Acrylic Epoxy	1 coat, 4.0 MDFT
	Finish: Ceramic Modified Water Borne Aliphatic Polyurethane Enamel	1 coat, 2.0 MDFT

P. System No. 15 Concrete/CMU- Below Grade (as required by application schedule):

Surface Prep.	Paint Material	Min. Coats. Cover
SP 13	Filler: Surface Repair Mortar or Epoxy Filler	As required to form a smooth surface profile or as shown on drawings
	Finish: Polyamide High Build Coal Tar Epoxy	15 MDFT minimum

2.3 ABRASIVE MATERIALS

A. Select abrasive type and size to produce surface profile that meets coating Manufacturer's recommendations for specific primer and coating system to be applied.

2.4 PAINT MATERIALS

A. General:
   1. Manufacturer's highest quality products suitable for intended service.
   2. Compatibility: Only compatible materials from a single Manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats.
   3. Thinners, Cleaners, Driers, and other additives: As recommended by Manufacturer of coating material.

B. Products:

Product	Definition
Polyamide Epoxy Primer and High Build Epoxy	Pure polyamide epoxy primer suitable for immersion service: 78% Volume Solids Minimum. Provide the following test data: • ASTM B 117 (Salt Spray-Fog): 10,000 hours • ASTM D 4541 (Adhesion): • ASTM G 85 (Prohesion): 15,000 hours • ASTM D 870 (Immersion): 140° DI Water – 5,000 hours
Coal-Tar Epoxy	Amine or phenolic epoxy type: 75% volume solids minimum, suitable for immersion service
Organic Zinc Rich Urethane Primer	Moisture cured zinc rich urethane containing a minimum of 83% zinc content in the dried film (ASTM D520 Type III). Provide the following test data: • ASTM B 117 (Salt Spray-Fog): 50,000 hours • ASTM D 4541 (Adhesion): • ASTM G 85 (Prohesion): 15,000 hours
Fiberglass Reinforced Polyamine Epoxy	100% solids by volume, fiberglass reinforced polyamine epoxy suitable for exposure to high levels of H2S and H2S04. Provide the following test data: • ASTM G 210 – Severe Wastewater Analysis Test: 28 Days H2S AutoClave 150ºF, 500ppm H2S, 4,000 ppm NaCL, 10% H2S04. Report initial impedance (log Z) and impedance (log Z) after 28 days exposure • ASTM D 7234 (Adhesion – 20mm dolly): • ASTM C 868 (Chemical Resistance) 25% Sulfuric Acid – 100 days immersion
Aliphatic Acrylic Polyurethane	Aliphatic acrylic urethane containing a blend of ultra violet light absorbers for enhance color and gloss durability. Provide the following test data: • ASTM D 4541 (Adhesion): • ASTM B 117 (Salt Spray-Fog): 5,000 hours • ASTM D 4141 (EMMAQUA): 1,000 mj/m2 Exposure • ASTM D 4587 (QUV): 7,000 hours exposure.
Epoxy Nonskid (Aggregated)	Polyamide or amine converted epoxies aggregated; aggregate may be packaged separately
Epoxy Filler/Surfacer	100% solids epoxy trowel grade filler and nonshrinking, surfacer suitable for application to concrete and masonry. Approved for potable water contact and conforming to NSF 61, where required
Modified Polyamine High Build Epoxy Coating	82% solids by volume modified polyamine epoxy suitable for immersion in potable water and wastewater. NSF approved for tanks of 500 gallons capacity or greater. Provide the following test data: • ASTM B 117 (Salt Spray-Fog): 10,000 hours • ASTM D 4541 (Adhesion): • AWWA C210: Meets performance requirements • ASTM D 870 (Immersion): 140° DI Water – 2,000 hours • ASTM D 4585 (Humidity): 2,000 hours

2.5 MIXING

A. Multiple-Component Coatings:
   1. Prepare using the contents of the container for each component as packaged by paint Manufacturer.
   2. No partial batches will be permitted.
   3. Do not use multiple-component coatings that have been mixed beyond their pot life.
   4. Furnish small quantity kits for touchup painting and for painting other small areas.
   5. Mix only components specified and furnished by paint Manufacturer.
   6. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

B. Colors: Formulate paints with colorants free of lead, lead compounds, or other materials that might be affected by presence of hydrogen sulfide or other gas likely to be present at the site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Surface Preparation Verifications:
   1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed directions and recommendations of paint Manufacturer whose product is to be applied. The more stringent requirements shall apply.
   2. Provide Engineer minimum 7 days advance notice to start of shop or field surface preparation work and coating application work.
   3. Perform such work only in presence of Engineer, unless Engineer grants prior approval to perform such work in Engineer's absence.

B. Schedule inspection with Engineer in advance for cleaned surfaces and all coats prior to succeeding coat.

3.2 PREPARATION

A. Shop Blast Cleaning:
   1. Notify Engineer at least 7 days prior to start of shop blast cleaning to allow for inspection of the work during surface preparation and shop application of paints.
   2. Structural steel, metal doors and frames, metal louvers, and similar items, as reviewed by Engineer, may be shop prepared and primed.

B. Field Abrasive Blasting: Perform blasting for items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed.

C. Protection of Items not to be painted:

1. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.
2. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.
3. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.
4. Mask openings in motors to prevent paint and other materials from entering the motors.

3.3 PREPARATION OF SURFACES

A. Metal Surfaces:
   1. Where indicated, meet requirements of the following SSPC Specifications:
      a. Solvent Cleaning: SP 1.
      b. Hand Tool Cleaning: SP 2.
      c. Power Tool Cleaning: SP 3.
      d. White Metal Blast Cleaning: SP 5.
      e. Commercial Blast Cleaning: SP 6.
      f. Brush-Off Blast Cleaning: SP 7.
      g. Pickling: SP 8.
      h. Near-White Blast Cleaning: SP 10.
      i. Power Tool Cleaning to Bare Metal: SP 11.
      j. Surface Preparation of Concrete: SP 13.
   2. The words “solvent cleaning”, “hand tool cleaning”, “wire brushing” and “blast cleaning”, or similar words of equal intent in these Specifications, or in paint manufacturer’s specifications, refer to the applicable SSPC Specifications.
   3. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating Manufacturers’ recommendations for wet blast additives and first coat application shall apply. If not otherwise required, contractor shall provide abrasive blast cleaning by means of sand blasting or high pressure water.
   4. DeLavaud Process Ductile Iron Pipe:
      a. Use SSPC SP grades as guide only.
      b. For high performance (epoxy) coatings, follow recommendations of pipe and coating Manufacturers.
      c. The surface preparation and application of the primer and finish coats shall be performed by the pipe Manufacturer
      d. For conventional (alkyd) coatings, clean asphalt varnish supplied on pipe and apply one full coat of a tar stop before two full coats of the color coats specified.
   5. Hand tool clean areas that cannot be cleaned by power tool cleaning.
   6. Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.
   7. Welds and Adjacent Areas:
      a. Prepare such that there is:

1) No undercutting or reverse ridges on weld bead.
2) No weld spatter on or adjacent to weld or any other area to be painted.
3) No sharp peaks or ridges along weld bead.

b. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

8. Pre-blast Cleaning Requirements:
   a. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.
   b. Cleaning Methods: Steam, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.
   c. Clean small isolated areas as above or solvent clean with suitable solvents and clean cloths.
9. Blast Cleaning Requirements:
   a. Type of Equipment and Speed of Travel: Design to obtain specified degree of cleanliness. Minimum surface preparation is as specified herein and takes precedence over coating Manufacturer's recommendations.
   b. Select type and size of abrasive to produce a surface profile that meets coating Manufacturer's recommendations for particular primer to be used.
   c. Use only dry blast cleaning methods, unless otherwise directed in writing by Engineer.
   d. Do not reuse abrasive material, except for designed recyclable systems. Must meet applicable federal, state, and local air pollution and environmental control regulations for blast cleaning, confined space entry (if required), and disposition of spent aggregate and debris.
10. Post-Blast Cleaning and Other Cleaning Requirements:
    a. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wipe with a tack cloth.
    b. Paint surfaces the same day they are blasted. Re-blast surfaces that have started to rust before they are painted.

B. Galvanized Surfaces:
   1. Remove soil, cement spatter, and other surface dirt with appropriate hand or power tools.
   2. Remove oil and grease by wiping or scrubbing the surface with a suitable solvent, rags and brushes. Use clean solvent and clean rags for the final wiping to avoid contaminating the surface.
   3. Clean in accordance with SSPC-SP 16.

C. Concrete Surfaces:
   1. Do not begin until 30 days after concrete has been placed.
   2. Remove grease, oil, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent, or other suitable cleaning methods.
   3. Clean to remove loose concrete and provide a surface for binding according to SP-13 Surface Preparation of Concrete. Surface may not be cleaned by acid etching

or open flame methods unless approved in writing by Engineer. Contractor must provide evidence that method will produce desired profile without causing damage to concrete member.

a. Mechanical Surface Preparation Methods: (according to section 4 of SP-13)
   1) Dry abrasive blasting (sand blasting)
   2) Wet abrasive blasting
   3) Vacuum-assisted abrasive blasting
b. Vacuum cleaning, air blast cleaning, and/or water cleaning as described by ASTM D4258 shall be used after the completion of one or more of the mechanical surface preparation methods listed above.
c. Final surface preparation shall be as required by coatings manufacturer to insure proper adhesion of the coatings, as needed.

4. Contractor is responsible for coordinating and insuring that manufacturer's protective coatings are compatible with mortar repair or cement lining prior to submitting coatings.
5. Unless otherwise required for proper adhesion, ensure surfaces are dry prior to painting.

D. Plastic Surfaces:
1. Hand sand plastic surfaces to be coated with a medium grit sandpaper to provide tooth for the coating system.
2. Large areas may be power sanded or brush-off blasted, provided sufficient controls are employed so surface is roughened without removing excess material.

3.4 SURFACE CLEANING METHODS

A. Brush-off Blast Cleaning:
1. Equipment, procedure, and degree of cleaning shall meet requirements of SSPC-SP 7, Brush-off Blast Cleaning.
2. Abrasive: Either wet or dry blasting sand, grit, or nut shell.
3. Select various surface preparation parameters such as size and hardness of abrasive, nozzle size, air pressure, and nozzle distance from surface such that surface is cleaned without pitting, chipping, or other damage.
4. Verify parameter selection by blast cleaning a trial area that will not be exposed to view.
5. Engineer will approve acceptable trial blast cleaned area and will use area as a representative sample of surface preparation.
6. Repair or replace surfaces damaged by blast cleaning.

B. Acid Etching:
1. After pre-cleaning, spread the following solution by brush or plastic sprinkling can: 1 part commercial Muriatic acid reduced by 2 parts water by volume. Adding acid to water in these proportions gives an approximate 10% solution of HCl.
2. Application:
   a. Application Rate: Approximately 2 gallons per 100 square feet.
   b. Work acid solution into surface by hard-bristled brushes or brooms until complete wetting and coverage is obtained.

c. Acid will react vigorously for a few minutes, during which time brushing is continued.
d. After bubbling subsides (10 minutes), hose down the remaining slurry with high pressure clean water.
e. Rinse immediately to avoid formation on the surface of salts that are difficult to remove.
f. Thoroughly rinse to remove any residual acid surface condition which can impair adhesion.

3. Ensure surface is completely dry before application of coating.
4. Apply acid etching, to obtain a "grit sandpaper" surface profile. If not, repeat treatment.

C. Solvent Cleaning:
1. Consists of removal of foreign matter such as oil, grease, soil, drawing and cutting compounds, and any other surface contaminants by using solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods which involve a solvent or cleaning action.
2. Meets requirements of SSPC-SP 1.

3.5 APPLICATION

A. General:
1. Extent of Coating (Immersion): Coatings shall be applied to all internal vessel and pipe surfaces, nozzle bores, flange gasket sealing surfaces, carbon steel internals, and stainless steel internals, unless otherwise specified.
2. For coatings subject to immersion, obtain full cure for completed system. Consult coatings Manufacturer's written instructions for these requirements. Do not immerse coating for any purpose until completion of curing cycle.
3. Apply coatings in accordance with these Specifications and the paint Manufacturers' printed recommendations and special details. The more stringent requirements shall apply. Allow sufficient time between coats to assure thorough drying of previously applied paint.
4. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
5. Sand wood and metal lightly between coats to achieve required finish.
6. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
7. Fusion Bonded Coatings Method Application: Electrostatic, fluidized bed, or flocking.
8. Coat units or surfaces to be bolted together or joined closely to structures or to one another prior to assembly or installation.
9. Where more than one coat of a material is applied within a given system, alternate color to provide a visual reference that the required number of coats have been applied.

B. Galvanized Metal:

1. Concealed galvanized surfaces (behind building panels or walls) do not required painting unless specifically indicated herein.
2. Prepare surface and apply wash primer or coating Manufacturer's recommended coating. This primer will replace the required paint system's indicated primer.
3. Apply coating system appropriate for the exposure (intermediate/finish coats).

C. Shop Primed and Factory Finished Surfaces:
1. Schedule inspection with Engineer before shop priming or top-coating factory finished items delivered to site.
2. Prepare surfaces and spot prime using specified primer.
3. Apply mist coat of primer, 1-mil dry film thickness.
4. After welding, prepare and prime holdback areas as required for paint system. Apply primer in accordance with Manufacturer's instructions.

D. Manufacturer Applied Paint Systems:
1. Repair abraded areas on factory finished items as recommended by Manufacturer.
2. Carefully blend repaired areas into original finish.
3. Fusion Bonded Coatings: Provide appropriate liquid repair kits for field use.

E. Film Thickness:
1. Number of Coats: Minimum required without regard to coating thickness. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in Manufacturers' products, and atmospheric conditions.
2. Maximum film build per coat shall not exceed coating Manufacturer's recommendations.
3. Film Thickness Measurements and Electrical Inspection of Coated Surfaces:
    a. Perform with properly calibrated instruments.
    b. Recoat and repair as necessary for compliance with the Specifications.
    c. All coats are subject to inspection by Engineer and coating manufacturer's representative.
4. Visually inspect concrete, nonferrous metal, plastic, and wood surfaces to ensure proper and complete coverage has been attained.
5. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.
6. Thickness Testing:
    a. After repaired and recoated areas have dried sufficiently, final tests will be conducted by the Engineer.
    b. Measure coating thickness specified in mils with a magnetic type dry film thickness gauge.
    c. Test finish coat, except zinc primer, galvanizing, and elastomeric coatings in excess of 25 mils dry, for holidays and discontinuities with an electrical holiday detector.
    d. Holiday detect coatings in excess of 25 mils dry with high voltage units recommended by the coating manufacturer.

e. Check each coat for correct millage. Do not make measurement before a minimum of 8 hours after application of coating.

F. Porous Surfaces, Such As Concrete, Masonry:
1. Filler/Surfacer: Use coating Manufacturer's recommended product to fill air holes, bug holes, and other surface defects.
2. Prime Coat: May be thinned to provide maximum penetration and adhesion.
a. Type and Amount of Thinning: Determined by paint manufacturer and dependent on surface density and type of coating.
3. Finish Coat: Use coatings Manufacturer's recommended product.

G. Damaged Coatings, Pinholes, and Holidays:
1. Feather edges and repair in accordance with recommendations of paint Manufacturer.
2. Apply finish coats, including touchup and damage-repair coats in a manner which will present a uniform texture and color-matched appearance.

H. Unsatisfactory Application:
1. If item has an improper finish color, or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.
3. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.
4. Repair defects in accordance with written recommendations of coating Manufacturer.
5. Leave staging and lighting up until Engineer has inspected surface or coating. Replace staging removed prior to approval by Engineer. Provide additional staging and lighting as requested by Engineer.

3.6 FIELD QUALITY CONTROL

A. Testing Gauges:
1. Provide a magnetic type dry film thickness gauge to test coating thickness specified in mils, as manufactured by Nordson Corp., Anaheim, CA, Mikrotest.
2. Provide an electrical holiday detector, low voltage, wet sponge type to test finish coat, except zinc primer, high-build elastomeric coatings, and galvanizing, for holidays and discontinuities as manufactured by Tinker and Rasor, San Gabriel, CA, Model M-1.
3. Provide a high voltage holiday detector for elastomeric coatings in excess of 25 mils dry film thickness. Unit to be as recommended by the coating Manufacturer.

3.7 MANUFACTURER'S SERVICES

A. Provide Manufacturer's representative at site in accordance with Section 01 79 00, DEMONSTRATION AND TRAINING, for installation assistance, inspection, and certification of installation.

3.8 CLEANUP

A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at the end of each day.

B. Upon completion of the Work, remove staging, scaffolding, and containers from the site or destroy in a legal manner.

C. Completely remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

3.9 APPLICATION SCHEDULE

A. Unless otherwise shown or specified, paint surfaces in accordance with the following application schedule. In the event of discrepancies or omissions, request clarification from Engineer before starting work in question.

B. System No. 1 Submerged Metal- General
   1. Metal surfaces new and existing below a plane 1 foot above maximum liquid surface, metal surfaces above maximum liquid surface that are part of immersed equipment, concrete embedded surfaces of metallic items, such as wall pipes, pipes, pipe sleeves, access manholes, gate guides and thimbles, and structural steel.
   2. Pumps, motors, equipment items, and accessories identified in the technical specifications to be coated with this system.
      a. Interior surface of suction inlet and volute of submersible influent pumps. Apply coating prior to pump testing.
   3. Exterior of submerged piping and valves other than stainless steel or PVC piping.
   4. Submerged pipe supports and hangers.
   5. Submerged stem guides.

C. System No. 2 Submerged Metal- Potable Water:
   1. Metal surfaces new and existing below a plane 1 foot above maximum liquid surface, metal surfaces above maximum liquid surface that are a part of immersed equipment, concrete embedded surfaces of metallic items, such as wall pipes, pipes, pipe sleeves, access manholes, gate guides and thimbles, and structural steel.
   2. Pumps, motors, equipment items, and accessories identified in the technical specifications to be coated with this system.
   3. All submerged metal surfaces are to be coated, including those sections that will be concealed after installation of equipment.

D. System No. 3 Ductile Iron Pipe- Non Submerged Inside Building: Use on the following items or areas:
   1. Interior ductile iron piping, new and existing located inside buildings.

E. System No. 4 Ductile Iron Pipe- Non Submerged Exterior Exposed: Use on the following items or areas:
   1. Exposed ductile iron piping, new and existing located outside of structures and exposed to weather or in a highly humid atmosphere, such as vaults.

F. System No. 5 Exposed Metal- General: Use on the following items or areas:
   1. Exposed metal surfaces, new and existing located inside or outside of structures and exposed to weather or in a highly humid atmosphere, such as vaults, chemical rooms, and other similar areas.
   2. Interior exposed structural steel, metal building structure, bolted connection and other exposed metal structures of electrical rooms.
   3. Pumps, motors, equipment items, and accessories identified in the technical specifications to be coated with this system.
   4. Pipe, valves, pipe hangers, supports and saddles, conduit, cable tray hangers, and supports.
   5. Valve operator and stands.
   6. Mechanical equipment supports, drive units, and accessories.

G. System No. 6 Exposed Metal-High Temperature (150 to 350 degrees Fahrenheit): Use on the following areas or items:
   1. Metal surfaces subject to temperatures ranging from 150 to 350 degrees Fahrenheit.
   2. Blowers, blower piping, and blower accessories, pumps, motors, equipment items, and accessories identified in the technical specifications to be coated with this system.

H. System No. 7 Buried Metal- General: Use on the following items or areas:
   1. Buried, below-grade portions of steel items, except buried stainless steel or ductile iron pipe.

I. System No. 8 Galvanized Metal Conditioning: Use on the following items or areas:
   1. Galvanized surfaces requiring painting.
   2. After application of System 10, apply finish coats as required for exposure.

J. System No. 9 Galvanized Metal Repair: Use on the following items or areas:
   1. New or existing galvanized surfaces that are abraded, chipped, or otherwise damaged.

K. System No. 10 Exposed PVC: Use on the following items or areas:
   1. All exterior exposed-to-view PVC and CPVC surfaces, and FRP surfaces.

L. System No. 11 Aluminum and Dissimilar Metal Insulation: Use on the following items or areas:

1. Aluminum surfaces embedded or in contact with concrete, masonry, and other metals.
2. Stainless steel surfaces embedded in concrete.
3. Dissimilar metals for electrical insulation.
4. All other miscellaneous aluminum framing members and pipe supports.

M. System No. 12 Existing Concrete/CMU- Repair:
1. All surfaces as indicated on the drawings.
2. Interior surfaces of all liquid containing structures where concrete or CMU are indicated to be repaired or rehabbed, unless noted otherwise.
3. Exterior exposed surfaces noted to be repaired as required for architectural painting.
4. As required to repair/patch areas damaged or altered during construction.

N. System No. 13 New Concrete/CMU- Exterior (as indicated below only):
1. All surfaces as indicated on the drawings.
2. All exposed exterior surfaces shall receive coatings for moisture protection and architectural painting as indicated below:

O. System No. 14 Concrete/CMU- Interior or Immersion Mildly Corrosive:
1. All surfaces as indicated on the drawings.
2. Interior surfaces of rooms containing process piping and/or equipment only as indicated herein or on the drawings.

P. System No. 15 Concrete/CMU- Below Grade (as indicated below only):
1. All surfaces as indicated on the drawings.
2. All unexposed below grade surfaces shall receive coatings for moisture protection as indicated below:

Q. Surfaces Not Requiring Protective Painting: Unless otherwise stated or shown, the following areas or items will not require protective painting or coating:
1. Reinforcing steel.
2. Nonferrous and corrosion-resistant ferrous alloys such as copper, bronze, Monel, aluminum, chromium plate, atmospherically exposed weathering steel, and stainless steel, except where:
    a. Required for electrical insulation between dissimilar metals.
    b. Aluminum and stainless steel are embedded in concrete or masonry, or aluminum is in contact with concrete or masonry.
    c. Color coding of equipment and piping is required.
3. Nonmetallic materials such as glass, PVC, wood, porcelain, and plastic (FRP) except as required for exposed-to-view PVC and CPVC, as required for FRP without integral UV resistant gel coat, and as required for architectural painting or color coding.
4. Pre-finished electrical items such as motor control centers, switchboards, switchgear, panelboards, transformers, disconnect switches (if pre-finished in OSHA yellow); except color coding of equipment is required.
5. Non-submerged electrical conduits attached to unpainted concrete surfaces.
6. Cathodic protection anodes.

3.10 COLORS

A. General: Provide manufacturer's full range of color charts to Owner/Owner's Representative for selection and/or approval. Provide colors as indicated in, Door and Hardware Schedule, Interior Finish Schedule, Exterior Finish Schedule, as shown on the drawings, as selected by Owner, and as designated herein.

B. Pipe Identification Painting:
   1. Color code non submerged metal piping except electrical conduit. Paint fittings and valves the same color as pipe, except equipment isolation valves.
   2. Piping Color Coding: In accordance with Piping Schedule.
   3. On exposed stainless steel piping, apply color 24" in length along pipe axis at connections to equipment, valves, or branch fittings, at wall boundaries, and at intervals along piping not greater than 9' on center.
   4. Pipe Supports: Mild steel, painted No. 70 light gray as specified in ANSI 359-A, as manufactured by Tnemec Co., No. BJ45.

C. Proprietary identification of colors is for identification only. Selected Manufacturer may supply matches.

D. Equipment Colors:
   1. Equipment includes the machinery or vessel itself plus the structural supports and fasteners and attached electrical conduits.
   2. Paint equipment and piping one color as selected.
   3. Paint non submerged portions of equipment the same color as the piping it serves, except as itemized below:
      a. Dangerous Parts of Equipment and Machinery: OSHA Orange.
      b. Fire Protection Equipment and Apparatus: OSHA Red.
      c. Radiation Hazards: OSHA Purple.
      d. Physical hazards in normal operating area and energy lockout devices, including, but not limited to, electrical disconnects for equipment and equipment isolation valves in air and liquid lines under pressure: OSHA Yellow.
   4. Fiberglass reinforced plastic (FRP) equipment with an integral colored gel coat does not require painting, provided the color is as selected.

END OF SECTION

PAINT SYSTEM DATA SHEET

Complete and attach Manufacturer's Technical Data Sheet to this PSDS for each coating system.

Paint System Number (from Spec):		
Paint System Title (from Spec):		
Coating Supplier:		
Representative:		
Surface Preparation:		
Paint Material (Generic)	**Product Name/Number (Proprietary)**	**Min. Coats, Coverage**

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DIVISION 22

PLUMBING

SECTION 22 05 00
PLUMBING GENERAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK:

A. Provide equipment, labor, material, etc., required to make a complete working installation as shown or as specified.

B. Equipment and materials used in the work shall be:
   1. In accordance with the contract documents.
   2. The best quality and grade for the use intended.
   3. New and unused.
   4. The manufacturer's latest standard or current model.

C. All equipment and method shall be installed and connected in accordance with the best engineering practices and in accordance with the manufacturer's recommendations.

D. Mechanical work includes, but is not limited to:
   1. Make arrangements with local utility company for services as shown or specified.
   2. Obtain all permits and inspections including: Building permits, health department permits and sewer tap permits.
   3. Disconnect, remove and re-install mechanical services located on or crossing through contract limits, above or below grade, obstructing construction of project or conflicting with completed project or any applicable codes.
   4. Modify, extend or tie-into existing mechanical services or systems.
   5. Complete alterations and additions to the domestic water distribution system.
   6. Provide cutting of pavement, sidewalks, driveways, etc., excavating, trenching, shoring and de-watering. Provide backfill material and perform backfilling.
   7. Restore site to original condition or new final grades. Provide paving, concrete, seed, or sod.
   8. Complete alterations and additions to the domestic hot and cold water system. Provide sanitary rinse and flush.
   9. Complete alterations and additions to the interior sanitary sewer.
   10. Provide roofing including flashing, and counter flashing for roof mounted equipment; roof penetrations and supports for work in this Division, unless noted otherwise.

1.3 UTILITY CONNECTIONS:

A. Arrange with local utility companies for utility service connections, taps, meters and installation. Pay all fees and charges (if any) necessary for the utility services shown on the drawings or listed in the specifications.

B. It is the responsibility of the Contractor to re-confirm with the Utility Companies, prior to bidding, that locations, arrangements, line sizes, pressures, interruptions, shut downs, etc. are in accordance with their regulations and requirements.

C. If the utility company requirements are at variance with these drawings and specifications, this Contractor shall include the utility company requirements in his work without additional cost to the Owner.

D. Obtain from Utility Company any additional charges for service of type, size and location called for. Include charges in bid to be paid by Contractor to appropriate party. Provide payment of these charges so as to allow logical progression of construction and avoid delay of completion.

E. Should cost above not be available prior to bid, submit with bid a letter signed by responsible Utility Company personnel stating that cost is not available. Prime Contractor shall submit letter with his bid to Owner. Cost will then be omitted from contract and become responsibility of Owner.

F. Furnish with shop drawings a signed document from each utility company describing location and type of service to be supplied and requirements for service. Document shall be signed by the appropriate responsible representative of the respective utility company.

1.4 WORK NOT INCLUDED:

A. Electrical wiring and conduits shown on the electrical drawings.

B. Asbestos removal.

1.5 RELATED WORK SPECIFIED ELSEWHERE:

A. Electrical: Division 26.

1.6 REQUIREMENTS OF REGULATORY AGENCIES:

A. Obtain and pay for all permits required for the work. Comply with all ordinances pertaining to work described herein.

B. Install the work under this Division in accordance with drawings and specifications and the standards and codes (latest edition) that apply to this work. In the event of a conflict, install work in accordance with the most stringent code requirements determined by Engineer.

C. Arrange, pay for and complete work to pass required tests by agencies having authority over work. Deliver to Engineer Certificates of Inspection and approval issued by authorities.

1.7 QUALIFICATION OF CONTRACTOR:

A. Has completed minimum two projects same size and scope in past five (5) years.

B. This qualification applies to Sub-Contractors.

C. Use workmen experienced in their respective trade. Submit qualifications of Superintendent for review.

D. Owner reserves right to reject bid of any Contractor failing to meet these qualifications.

1.8 GENERAL JOB REQUIREMENTS:

A. Drawings and Specifications:
1. Drawings and specifications are complementary. Work called for by one is binding as if called for by both.
2. Drawings are drawn to a small scale and are diagrammatic only. The drawings indicate size and general arrangement of equipment.
3. Do not scale drawings for exact locations. Refer to dimensional plans. Field measurements take precedence.

B. Provide all necessary offsets, elbows and fittings in piping as required to avoid conflict with work of other trades. Maintain proper headroom and clear passageways to allow adequate access and working clearances for equipment dampers, valves, etc. This shall be done at no additional cost to the Owner.

C. Visit to Site/Work in other Division:
1. Examine not only the plans and specifications for this Division, but plans and specifications of the other Divisions of work and visit the site to become acquainted with existing conditions. Execution of Contract is evidence that Contractor has examined all drawings and specifications, and that all conditions which have a bearing in any way on the manner of installing the work in this Division are known. Later claims for labor and materials required due to difficulties encountered will not be recognized.

D. Underground Utilities/Concealed Utilities:
1. All utilities and services, whether shown on the drawings or not, shall be suitably protected and maintained, and any damages thereto shall be promptly repaired. Owner shall be advised immediately of any damages sustained. If any extra expense is incurred due to the existence of buried utilities not shown on the drawings, or the location of which is not made known to the Contractor, the contract price shall be adjusted in accordance with the General Conditions. The Contractor shall advise the Owner three (3) days in advance of any operation which could possibly disrupt any underground utility. The Contractor shall utilize

locator services to mark any underground utilities in the area he is working in, and shall make any other measure deemed necessary to avoid utility disruption.

E. Definitions:
1. Concealed: Materials or systems not visible. Work installed above a ceiling, furred behind a wall or enclosed in a chase.
2. Exposed: Materials or systems that is visible. Work installed in a room without a ceiling. Work not enclosed by walls.
3. Provide: Furnish, install and make complete.
4. Install: Receive, unload, move into place, and make connections.
5. Work: Materials completely installed and connected.
6. ADC: Air Diffusion Council.
7. AGA: American Gas Association.
8. AMCA: Air Movement and Control Association.
9. ANSI: American National Standard Institute.
10. API: American Petroleum Institute.
11. ARI: American Refrigeration Institute.
12. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers.
13. ASME: American Society of Mechanical Engineers.
14. ASTM: American Society of Testing Materials.
15. AWS: American Welding Society.
16. FM: Association of Factory Mutual Fire Insurance Company.
17. International: Building Code, Gas Code, Mechanical Code, Plumbing Code.
18. MSS: Manufacturer's Standard Society of the Valve and Fittings Industry, Inc.
19. NEC: National Electrical Code.
20. NEMA: National Electrical Manufacturer's Association.
21. NFPA: National Fire Protection Association.
22. NRCA: National Roofing Contractors Association.
23. NSF: National Sanitation Foundation.
24. OSHA: Occupational Safety and Health Act.
25. PDI: Plumbing Drainage Institute.
26. PFMA: Power Fan Manufactures Association.
27. SMACNA: Sheet Metal and Air Conditioning Contractors National Association.
28. International: Building Code, Gas Code, Mechanical Code, Plumbing Code.
29. UL: Underwriters Laboratories.

F. Workmanship, Warranty and Acceptance:
1. Work under this Division shall be first class with emphasis on neatness and workmanship.
2. Install work using competent mechanics, under supervision of foreman, all duly certified by local authorities. Installation subject to Engineer's observation, final approval, and acceptance. Engineer may reject unsuitable work.
3. Furnish Engineer written warranty, stating that if workmanship and/or materials executed under this Division are proven defective within one (1) year after final

acceptance, such defects and other work damaged will be repaired and/or replaced.

4. In event that project is occupied or system placed in operation in several phases at Owner's request, warranty will begin on date each system or item of equipment is accepted by Owner.

G. Observations of Work and Demonstration of Operation:
   1. When observations are scheduled, provide sufficient personnel to expedite removal of access doors, cover plates, manholes covers, etc.
   2. Contractor to assist Engineer in demonstration of operation of new systems to satisfaction of Owner. Contractor to have manpower available for demonstration of systems where requested by Owner.

H. Materials and Substitutions:
   1. All materials shall be new. All materials and equipment, for which a UL Standard, an AGA approval, an AWWA standard, FM listing or ASME requirements is established, shall be so approved and labeled or stamped.
   2. Wherever in these specifications products are specified by manufacturer's name, bids shall be based on the named products. Where more than one manufacturer's name is mentioned, the one first listed establishes the standard for that product. If the bidder desires to submit a product of a manufacturer other that listed first, it must be the equivalent of the one listed first.
   3. The drawings are based on the use of products specified and listed first. If any revision in piping, ductwork, conduit work, foundations, anchor bolts, connections, etc., is required by other named products or approved substitutions, it shall be the Contractor's responsibility to make such revisions at no additional expense to the Owner.
   4. If any bidder desires to submit products of manufacturers not listed, he may submit a request for prior approval to the Engineer no later than 10 days prior to the bid date. If the Engineer decides to accept the manufacturers, they will be listed as "Approved" by written addendum.
   5. If the manufacturers are not listed as approved either by addendum or in the specifications, they will not be accepted.

I. Shop and Erection Drawings:
   1. Shop drawings shall be submitted on a timely basis to allow adequate lead time for review, resubmission if necessary, manufacture and delivery to allow access of material to project at correct time based on schedule established by Engineer/Contractor. On each shop drawing include the specification section that applies to that submittal. Include complete descriptive data with dimensions, operating data and weight for each item of equipment. Carefully examine shop drawings to assure compliance with drawings and specifications prior to submittal to Engineer. Shop drawings and submittals shall bear the stamp of approval of the Contractor as evidence that the drawings have been checked by him. Drawing submitted without this stamp of approval will not be considered and will be returned for proper resubmission.

2. Drawings larger than 8-1/2" x 11", submit three (3) copies and one (1) reproducible of each drawing. Engineer will retain two (2) copies and return one (1) reproduction and one (1) copy to Contractor. Contractor is responsible for copying for distribution.
3. 8-1/2" x 11" drawings in brochure: Submit six (6) original copies for review. Engineer (and) Engineer will retain two (2) copies and return four (4) copies to Contractor. Division 01 "General Conditions" take precedence over this specification.
4. Review of shop drawings does not relieve Contractor of responsibility for errors and omissions in shop drawings. Contractor's responsible for meeting the requirements of the contract documents.
5. Contractor is responsible for dimensions and sizes of equipment. Inform Engineer in writing of equipment differing from that shown.
6. Prepare erection drawings when required by Engineer. Investigate thoroughly all conditions affecting work and indicate on drawing. Engineer will review erection drawings before work commences.

J. Operating and Maintenance Manuals:
1. Provide maintenance and operating manuals bound in 8-1/2" x 11" hardback, three-post binders. Manuals shall contain written instructions for each system, shop drawings, schematic drawings, equipment catalog cuts, manufacturer's instructions, manufacturer's warranties, and valve tag list.
2. Arrange information in the following sequence: title of job, Owner, address, date of submittal, name of Contractor, name of Engineer, index, shop drawings, operating instruction, Contractor's purchase order numbers, supplier's name and address, date of start-up of each piece of equipment and valve tag list.
3. Submit one (1) copy for review. Make required corrections, and submit two (2) record copies.

K. Record Drawings:
1. Contractor shall maintain at the site one (1) copy of the drawings in good order and marked to record all changes made during construction.
2. Contractor shall update all drawings to incorporate all changes and deliver one (1) set of reproducible plans and one (1) electronic copy of the project in the latest "AutoCAD" version to the Owner upon completion of the work.

1.9 PROTECTION AND STORAGE:

A. Provide warning lights, bracing, shoring, rails, guards and covers necessary to prevent damage or injury.

B. Protect all equipment and materials, from damage by weather, entrance of water or dirt. Cap open piping, use plastic covers made for that purpose. Do not use rags or construction debris.

C. Avoid damage to materials and equipment in place. Repair, or remove and replace damaged work and materials.

D. Protect all surfaces from weld spatter, solder and cutting oil.

E. Deliver equipment and materials to job site in original, unopened, labeled container. Store to prevent damage and injury. Store ferrous materials to prevent rusting. Store finished materials and equipment to prevent staining and discoloring. Store materials affected by condensation in warm dry areas. Provide heaters. Storage space on site and in building designated by Owner/Engineer.

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SECTION 22 05 53
MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other sections.

B. Types of identification devices specified in this section include the following:
   1. Painted Identification Materials.
   2. Equipment Labels.
   3. Plastic Pipe Markers.
   4. Plastic Tape.
   5. Underground-Type Plastic Line Marker.
   6. Valve Tags.
   7. Valve Schedule Frames.
   8. Engraved Plastic-Laminate Signs.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
   1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.3 SUBMITTALS

A. Product Data: Submit Manufacturer's technical product data and installation instructions for each identification material and device required.

B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate the valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 1.

C. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 01.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering mechanical identification materials which may be incorporated in the work include; but are not limited to, the following:
   1. Allen Systems, Inc.
   2. Brady (W.H.) Co.; Signmark Div.
   3. Industrial Safety Supply Co., Inc.
   4. Seton Name Plate Corp.

2.2 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide Manufacturer's standard products of categories and types required for each application as referenced in other sections. Selection is Installer's option where more than a single type is specified for applications but provide single selection for each product category.

2.3 PAINTED IDENTIFICATION MATERIALS

A. Stencils: Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications, but not less than 1-1/4" high letters for ductwork and not less than 3/4" high letters for access door signs and similar operational instructions.

B. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.

C. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, complying with ANSI A13.1 and/or Owner Selection for colors.

D. See Section 09 90 00, PAINTING AND PROTECTIVE COATINGS.

2.4 EQUIPMENT LABELS

A. Metal Labels for Equipment:
   1. Material and Thickness: Stainless steel, 0.025-inch (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
   3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   4. Fasteners: Stainless-steel rivets or self-tapping screws

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.5 PLASTIC PIPE MARKERS

A. Snap-On Type: Provide Manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

B. Pressure-Sensitive Type: Provide Manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, complying with ANSI A13.1.

C. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on un-insulated pipes subjected to fluid temperatures of 125 °F (52 °C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
   1. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360° around pipe at each location, fastened by one of the following methods:
      a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
      b. Adhesive lap joint in pipe marker overlap.
      c. Laminated or bonded application of pipe marker to pipe (or insulation).
      d. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".
   2. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
      a. Laminated or bonded application of pipe marker to pipe (or insulation).
      b. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, tape lapped 3".
      c. Trapped-to-pipe (or insulation) application of semi-rigid type, with Manufacturer's standard stainless steel bands.

D. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with name as shown or specified.
   1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.6 PLASTIC TAPE

A. General: Provide Manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.

C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.7 UNDERGROUND-TYPE PLASTIC LINE MARKERS

A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.

B. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

2.8 VALVE TAGS

A. Brass Valve Tags: Provide 19-gauge polished brass valve tags, with a stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.
   1. Provide 1-1/2" diameter tags, except as otherwise indicated.
   2. Provide size and shape as specified or scheduled for each piping system.
   3. Fill tag engraving with black enamel.

B. Plastic Laminate Valve Tags: Provide Manufacturer's standard 3/32" thick engraved plastic laminate valve tags, with piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.
   1. Provide 1-1/2" sq. black tags with white lettering, except as otherwise indicated.
   2. Provide size, shape and color combination as specified or scheduled for each piping system.

C. Valve Tag Fasteners: Provide Manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

D. Access Panel Markers: Provide Manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.

2.9 VALVE SCHEDULE FRAMES

A. General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.10 ENGRAVED PLASTIC-LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.11 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
   1. Stenciled markers, including color-coded background band or rectangle, and contrasting lettering of black or white. Extend color band or rectangle 2" beyond ends of lettering.
   2. Stenciled markers, with lettering color complying with ANSI A13.1.

3. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.
4. Stenciled markers, black or white for best contrast, wherever continuous color-coded painting of piping is provided.
5. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
    a. Near each valve and control device.
    b. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
    c. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
    d. At access doors, manholes and similar access points which permit view of concealed piping.
    e. Near major equipment items and other points of origination and termination.
    f. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
    g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.5 UNDERGROUND PIPING IDENTIFICATION

A. General: During back-filling/top-soiling of each exterior underground piping system, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker. For tile fields and similar installations, mark only edge pipe lines of field.

3.6 VALVE IDENTIFICATION

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

B. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Contracting Officer.

C. Where more than one major machine room is shown for project, install mounted valve schedule in each major machine room, and repeat only main valves which are to be operated in conjunction with operations of more than single machine room.

3.7 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.8 EXTRA STOCK

A. Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

B. Where stenciled markers are provided, clean and retain stencils after completion of stenciling and include used stencils in extra stock, along with required stock of stenciling paints and applicators.

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SECTION 22 11 16
PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. The work required under this section includes all work necessary for a complete installation of domestic water piping inside the building to 5 feet outside the building, and sanitary waste piping to a point as indicated on the drawings.

B. The work of this section is subject to the requirements of the Plumbing General Section.

1.2 SUBMITTALS:

A. Submit schedule of pipe and fittings for each service.

1.3 CODES AND STANDARDS:

A. International Plumbing Code, 2006

PART 2 - PRODUCTS

2.1 GENERAL:

A. Refer to design drawings for approximate locations of pipe and for pipe size.

B. Domestic Water Piping:
   1. Water piping within building:
      a. 3 inch and smaller shall be copper tube, type "L" hard temper, ASTM.
   2. Piping below ground:
      a. 2" and smaller type "K" soft temper; ASTM B-88.

C. Sanitary Waste and Vent Piping:
   1. Schedule 40 PVC-DWV ASTM D-2665 using solvent cement ASTM D2564, for below slab only.
   2. No-Hub Cast Iron meeting CISPI Standards for all above slab piping.

D. Fittings - Domestic Water Piping:
   1. Wrought copper, solder type, ASTM B-75, ANSI B16.22

E. Fittings - Sanitary Waste and Vent Piping:
   1. Below ground:
      a. Schedule 40 PVC-DWV, ASTM D-2855 using solvent cement ASTM D-2564

F. Unions:

1. Solder unions shall be wrought copper, with copper ground joint. ASTM B75, ANSI B16.22.
2. Di-electric, EPSO, 250 lb. WOG.

G. Solder:
1. Solder Metal shall conform to ASTM B32-alloy grade 95TA: 95 percent tin, 5 percent antimony. Joints shall be made with approved solder containing not more than 0.2 percent lead.

H. Valves:
1. Approved Domestic manufacturers: Hammond, Kitz, Nibco, Apollo, Milwaukee, or approved equal.
2. Valves should be installed according to manufacturer's recommendations.
3. Valves 2-1/2" inches and smaller shall be equal to Nibco T-585-70, full port ball type with bronze body, chrome plated ball and bronze threaded ends, 600 psi WOG or Nibco S-585-70 in copper lines.

PART 3 - EXECUTION

3.1 GENERAL:

A. All piping shall be routed to conserve building space, be coordinated with items installed by other trades and not interfere with access to or operation of the facility.

B. Provide roof flashings for pipe penetrations through roof, to be installed by roofing contractor. Install roof drains as recommended by manufacturer and such that piping does not carry weight of roof drain.

C. Water piping within building shall be size indicated on plans and risers. In the event no size is shown, pipe size or size required by the Plumbing Code. Piping shall be sloped toward a system drain and toward outlets, to provide for system drain-down. Install piping to prevent direct contact between ferrous and non-ferrous materials. Allow flexibility for expansion in piping.

D. All water piping within building shall be installed on the interior side of building envelope insulation, except where installed underslab. Where installed in attic locations piping shall be insulated and installed low to trusses/structure with the envelope insulation installed on top of the piping. A poly vapor barrier shall be secured over the piping and under the building insulation. Where it is not physically possible to install the piping within the building thermal envelope, the piping shall be fitted with electric heat tracing for freeze protection. If heat tracing is utilized, heat trace and insulate all exposed piping, water lines, and valves less than 8" diameter and all equipment where water may collect. Where exact sizes, panels, boxes, conduit, circuitry and other items of construction are shown or required for a complete installation, but are not adequately identified as to size or material requirements, the materials furnished shall be as needed to provide freeze protection requirements as though shown in detail on the Drawings. The Contractor shall be responsible for supplying all items as required for complete heat tracing systems regardless of the level of detail shown on the Drawings.

E. Domestic water piping system shall be tested with potable water at a pressure of 125 psig or 25 psig above design working pressure, whichever is greater for 12 hours. Test shall be conducted with plumbing inspector unless approved otherwise in writing.

F. Water distribution piping shall be disinfected prior to occupancy or system start-up with a chlorine solution 50 ppm. Allow system to stand for six hours minimum; then exercise all valves to ensure treatment of all branches and components. System shall be flushed with potable water after disinfection and prior to placement into service.

G. Sanitary waste and vent piping shall be tested in accordance with water and air tests as specified in the International Plumbing Code, in addition to any tests required by the local plumbing official. (10 feet of head with no apparent leaks. Hold for 30 minutes minimum). Flush all gravity piping including floor drains and roof drains prior to turning over to the Owner.

3.2 PREPARATION:

A. All pipe shall be cut square. Ream pipe and tube ends and remove burrs. Clean the ends of pipes to remove oil, grease and oxides.

B. Prepare piping connections to equipment with flanges or unions.

C. All soldered piping and equipment connections shall be properly prepared in accordance with good piping practice. Apply a thin layer of flux to only the male tubing. Rotate into the fitting with one or two revolutions.

D. Where PVC is connected to hubless cast iron the connection must be made with special coupling press to compensate for differences in outside diameters of the two materials.

3.3 INSTALLATION:

A. Domestic Water Piping:
   1. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.
   2. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
   3. Provide clearance for installation of insulation and access to valves and fittings.
   4. Provide access where valves and fittings are not exposed.
   5. Install valves with stems upright or horizontal. Provide drain valves at low points in systems.
   6. Test cold water piping before being insulated, or concealed in walls or ceiling.

B. Sanitary Waste and Vent Piping:
   1. Horizontal soil, waste and drainage lines within building shall have a minimum uniform slope of 1/8 inch per foot on 4 inch and larger, and 1/4 inch per foot on lines 3 inch and smaller.

2. Turns in sanitary, soil, and drain piping shall be made using 45 degree elbows, wyes, quarter-, eighth-, or sixteenth bends, or other bends approved by the Plumbing Code.
3. Do not use sanitary tees or crosses except where discharging from horizontal to vertical.
4. Make changes in pipe sizes with reducing fittings and recessed reducers. Do not reduce line size in direction of flow.
5. Provide cleanouts in all horizontal turns in waste piping greater than 45 degrees.
6. Provide deep seal traps on all floor drains, and trap primers where required by code or as indicated on drawings.
7. Indirect waste lines dumping into floor or hub drains shall maintain a 2-inch air gap between the end of the waste line and the rim of the floor or hub drain.

3.4 APPLICATION:

A. Install unions downstream of valves and at equipment or apparatus connections. Install dielectric unions where joining dissimilar materials.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install brackets at cast iron no hub cleanouts to protect the integrity of the joint.

END OF SECTION

SECTION 22 11 23
NATURAL GAS PIPING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Provide complete installation of gas piping from the 'A' point of delivery up to and including connection to all gas-fired equipment.

1.2 CODES AND STANDARDS:

A. International Plumbing Code, 2006

B. International Gas Code, 2006

C. Canadian Standards Association (Formally American Gas Association)

D. NFPA 54

1.3 SUBMITTALS:

A. Submit manufacturer's literature on all piping, valves, fittings, etc.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS:

A. Schedule 40 black steel pipe ASTM A53, Grade A, B or type F continuous weld, electric weld or seamless with malleable iron class 150 fittings ANSI B16.3 on 2 inches and smaller and carbon steel butt welded fittings ASTM-A-234 on 2-1/2 inches and larger. Make screw joints using Teflon tape. Underground piping shall be coated with X-Tru-Coat or prior approved equal including joints and fittings. Use socket weld fittings on underground ASTM-A-105 with dimensions to ASME B16.11, MSS-SP79, on 2 inches and smaller.

B. UNIONS (DIELECTRIC):
1. Class 250 malleable, screwed ASTM-A-197.

C. VALVES:
1. Class 125 cast iron, screwed ANSI B16.33 full port for gas service, CSA listed, Homestead Figure 601 for 2 inches and smaller, and Homestead Figure 602 for 2-1/2 inch and larger; Resun or approved equal.
2. Ball Valves may be used for 2 inch and smaller, full port ball valve, 2 piece forged brass body, solid chrome plated ball, blow out proof stem, PTFE seats, UL 125/842 listed for flammable liquids and LP Gas, CSA listed for gas service equal to Hammond 8901, or approved equal. Valve should have following certifications; CGA 9.1 M9.7 Appliance Valves, ISA U.S. No. 3-88 House piping

systems, CR91-002 Indoor gas use, CGA-3.16-M88, Appliance & Equipment valves for natural gas & liquefied petroleum, ASME 16.33 Gas piping systems, Valves must have CSA and UL markings on valve body.

2.2 PRESSURE REGULATING VALVES:

A. Cast iron or aluminum body and spring case with stainless steel valve stem, seat ring and valve plug, plated steel springs, neoprene diaphragm and gaskets and TFE disc. Regulating valves shall be sized for the flow indicated and for inlet and outlet pressures indicated. Outlet pressure shall be maintained under the design flow condition and at no flow. Regulating valves over two psi shall be vented full size to outside of the building. Other regulating valves requiring access to the atmosphere shall be equipped with vent piping leading to outside. Provide a pressure relief valve if the regulator connection size exceeds two-inches. Regulating valves shall be Fisher, Maxitrol or prior approved equal meeting ANSI Z21.18.

1. Pressure Gage:

a. For medium pressure gas; 0-5 psi range. For low pressure gas; 0-30 inch W.C. range. Use low pressure type 2-1/2 inch dial pressure gage with appropriate range, OCI Model CO 34, Trerice, Weksler or approved equal.

2.3 PRESSURE RELIEF VALVES:

A. Cast iron or aluminum body and casing with stainless steel seat ring and valve plug, plated steel springs, neoprene diaphragm, nitrile O-rings and gaskets, and TFE piston ring. Relief valves shall be of sufficient size to relieve wide open flow of the regulator. Install relief valves outside of the building. Relief valves shall be Fisher, Maxitrol or prior approved equal.

PART 3 - EXECUTION

3.1 UNDERGROUND PIPING:

A. Perform work in accord with applicable C.S.A, State and local codes. Install gas stop valve and dielectric union where gas piping enters building.

3.2 GAS SERVICE:

A. Coordinate installation of gas service line with local gas company. Pay all fees.

3.3 INTERIOR PIPING:

A. Connect to entering line and distribute gas to equipment items requiring gas and as indicated. Perform work in accord with applicable C.S.A., N.F.P.A 54, State and local codes. Install gas stop valves and drip legs at each equipment item. Piping shall be adequately drained with a minimum slope of 1/4 inch per 15 feet and drip legs (full size of pipe) installed at additional points where condensate may collect. Install gas shut off valve and pressure gage inside building at gas entry. Install pressure reducing valves as required to provide pressure within equipment manufacturer's requirements.

3.4 CONNECTING:

A. Connect equipment items furnished under other sections of specifications.

3.5 TESTS:

A. Test in accord with C.S.A., Standard Gas code, N.F.P.A. 54, and applicable State and local codes.

3.6 ACCESS PANELS:

A. Provide access panels for valves and other items requiring maintenance in enclosed spaces. Avoid installing gas appurtenances in enclosed spaces where possible. Install in enclosed spaces only as allowed by applicable codes.

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SECTION 22 13 16
SANITARY, WASTE, AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Pipe, tube, and fittings.
   2. Specialty pipe fittings.
   3. Encasement for underground metal piping.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
   1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

1.4 SUBMITTALS

A. Product Data: For each type of pipe and product indicated.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
   1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to drawings for where different pipe materials are to be installed.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service classes.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and de-aerator drainage fittings.

C. CISPI, Hubless-Piping Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ANACO-Husky.
   b. Dallas Specialty & Mfg. Co.
   c. Fernco Inc.
   d. Matco-Norca, Inc.
   e. MIFAB, Inc.
   f. Mission Rubber Company; a division of MCP Industries, Inc.
   g. Stant.
   h. Tyler Pipe.
2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

E. Solvent Cement: ASTM D 2564.

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Shielded, Nonpressure Transition Couplings:
    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        1). Cascade Waterworks Mfg. Co.
        2). Mission Rubber Company; a division of MCP Industries, Inc.
    b. Standard: ASTM C 1460.
    c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Dielectric Fittings:
1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

2.6 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch (0.20-mm) or high-density, cross-laminated polyethylene film of 0.004-inch (0.10-mm) minimum thickness.

C. Form: tube.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes and ensure piping is clean of building foundation.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
   1. Building Sanitary Drain: 2 percent downward in direction of flow for 3-inch piping and smaller; 1 percent downward in direction of flow for 4-inch piping, and 0.8 percent downward in direction of flow for 6-inch piping. Consult Engineer for larger drain piping.
   2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
   3. Vent Piping: 1percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
   1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

N. Install aboveground PVC piping according to ASTM D 2665.

O. Install underground PVC piping according to ASTM D 2321.

P. Install engineered soil and waste drainage and vent piping systems as follows:
   1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
   2. Sovent Drainage System: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
   3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

Q. Plumbing Specialties:
   1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
   2. Include P-traps at all floor drains with double-sweep cleanouts downstream of each trap.

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves for piping penetrations of walls, ceilings, and floors

T. Install sleeve seals for piping penetrations of concrete walls and slabs.

U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
   1. Install transition couplings at joints of piping with small differences in OD's.
   2. In Drainage Piping: nonpressure transition couplings.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Division 23 Section "Hangers and Supports for Plumbing Piping and Equipment."
   1. Install galvanized steel pipe hangers for horizontal piping in noncorrosive environments.
   2. Install individual, straight, horizontal piping runs:
      a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
      c. Longer than 100 Feet (30 m) if indicated: MSS Type 49, spring cushion rolls.
   3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
   3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
   4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
   5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
   6. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

G. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
   3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.

4. NPS 6 and NPS 8 (DN 150 and DN 200): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

H. Install supports for vertical PVC piping every 48 inches (1200 mm).

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
   4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
   5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect PVC piping exposed to sunlight with coating as specified in Section 09 90 00.

3.10 PIPING SCHEDULE

A. Refer to drawings for pipe material requirements.

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DIVISION 23

HVAC

SECTION 23 34 23
HVAC PROPELLER WALL FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Propeller wall fans.

1.2 PERFORMANCE REQUIREMENTS

A. Operating Limits: Classify according to AMCA 99.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Belts: One set(s) for each belt-driven unit.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

PART 2 - PRODUCTS

2.1 PROPELLER WALL FANS

A. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.

B. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.

C. Fan Wheel: Replaceable, cast or extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

D. Fan Drive: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

E. Fan Drive:

1. Resiliently mounted to housing.
2. Statically and dynamically balanced.
3. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
4. Extend grease fitting to accessible location outside of unit.
5. Service Factor Based on Fan Motor Size: 1.4.
6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
7. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
8. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
9. Motor Pulleys: Adjustable pitch for use with motors through 5-HP; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
10. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
11. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

F. Accessories: Refer to drawings.

G. Capacities and Characteristics: Refer to drawings.

2.2 MOTORS

A. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Enclosure Type: Totally enclosed, fan cooled.

2.3 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Install units with clearances for service and maintenance.

C. Install in accordance with manufacturer’s installation instructions.

3.2 CONNECTIONS

A. Ground and wire equipment according to Division 26.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
9. Shut unit down and reconnect automatic temperature-control operators.
10. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Replace fan and motor pulleys as required to achieve design airflow.

D. Lubricate bearings.

END OF SECTION

SECTION 23 82 39.16
ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes propeller unit heaters with electric-resistance heating coils.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 2021.

D. Comply with UL 823.

2.2 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.3 HOUSINGS

A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.

B. Discharge Louver: Adjustable fin diffuser for horizontal units.

2.4 COILS

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath. Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F (288 deg C) at any point during normal operation.

1. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.
2. Wiring Terminations: Stainless-steel or corrosion-resistant material.

2.5 FAN AND MOTOR

A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

B. Motor: Permanently lubricated.

2.6 CONTROLS

A. Control Devices:
1. Unit or Wall-mounted thermostat as indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install unit heaters to comply with NFPA 90A.

B. Install unit heaters level and plumb.

C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

3.3 CONNECTIONS

A. Ground and wire equipment according to Division 26.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

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SECTION 23 91 16
HVAC WALL LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Operable, extruded-aluminum louvers.

1.2 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).

C. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).

D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain louvers from single source from single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

A. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
   1. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft. acting inward or outward.

2.3 OPERABLE, EXTRUDED-ALUMINUM LOUVERS

A. Louver Construction and Operation: Provide operable louvers with extruded-aluminum frames and blades not less than 0.080-inch (2.03-mm) nominal thickness, and with operating mechanisms to suit louver sizes.

   1. Hand operation with push bars.
   2. Crank operation with removable-crank operator in sill or jamb.
   3. Chain operation with tension spring, wall clip, pull chain, and 160 deg F (71 deg C) fusible link.
   4. Motor operation with operating parameters as indicated on the drawings.

B. Dual-Blade, Operable Louver: Fixed drainable blades and operable plain blades combined in single frame.
   1. Louver Depth: 6 inches (150 mm), overall.

   2. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Louver Construction: Provide fixed louvers with extruded-aluminum frames and blades not less than 0.080-inch (2.03-mm) nominal thickness.

B. Characteristics:

1. Louver Depth: 4 inches (150 mm), overall.

2. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.5 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
2. Horizontal Mullions: Provide horizontal mullions at joints unless continuous vertical assemblies are indicated.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: as required for wall construction.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.

F. Provide subsills made of same material as louvers or extended sills for recessed louvers.

2.6 LOUVER SCREENS

A. General: Provide screen at each exterior louver.
1. Screening Type: Insect Screening

2.7 EXTENDED SILLS

A. General: Provide extended sills at each louver.
1. Extended Sills: Extruded aluminum. Minimum nominal wall thickness 0.60 inches (1.5 mm).

2.8 INSTALLATION ANGLES

A. General: Provide manufacturer's installation angles and fasteners for each louver.

2.9 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Finish and color as indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required.

3.4 ADJUSTING AND CLEANING

A. Test operable louvers and adjust as needed to produce fully functioning units that comply with requirements.

B. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

D. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

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DIVISION 26

ELECTRICAL

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the basic requirements for electrical installations and includes requirements common to more than one section of Division 26. It expands and supplements the requirements specified in the General and Supplementary Conditions.

B. This project consists of construction of the new building structures, associated facilities, and all related electrical systems as defined in the plans and in these specifications.

C. The work includes the installation, connection and testing of new electrical equipment, including electrical services, power distribution equipment, lighting equipment, underground electrical work, grounding systems, control systems, conduit and wiring, coordination of traffic flow, temporary power systems, special electrical systems and all appurtenances to construct and demonstrate proper operation of the completed electrical systems.

D. The Contractor shall be responsible for the coordination of power, communication, and controls for the project.

E. The electrical plans do not give exact locations, etc., and do not show all the offsets, control lines, pilot lines, and other installation details. Each contractor shall carefully lay out the work at the sites to conform to the job conditions, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and thereby to provide complete operating systems.

F. The electrical plans show diagrammatically the locations of the various electrical outlets and apparatus and the general method of circuiting and controlling. Exact locations of these outlets and apparatus shall be determined by reference to the general plans and to all detail drawings, etc., by measurements at the buildings, and in cooperation with other crafts, and in all cases shall be subject to the approval of the Owner and Engineer. The Engineer reserves the right to make any reasonable change in location of any outlet or apparatus before installation, without additional cost to the Owner.

G. These specifications and the accompanying drawings are intended to cover systems which will not interfere with the structure of the buildings, which will fit into the several available spaces, and which will ensure complete and satisfactory systems. Each bidder shall be responsible for the proper fitting of the material and apparatus into the buildings.

H. Should the particular equipment which any bidder proposes to install require other space conditions than those indicated on the Drawings, the Bidder shall arrange for such space with the Engineer before submitting the bid. Should changes become necessary on account of failure to comply with this clause, the Contractor shall make such changes at the Contractor’s expense.

I. Where wire sizes, conduit and other items of construction are shown or required for a complete installation, but are not adequately identified as to size or material requirements, the materials furnished shall be in accordance with "Code" requirements as though shown in detail on the Drawings.

J. All equipment shall be leveled and made plumb. Metal junction boxes, equipment enclosures and metal raceways mounted on water or earth-bearing walls shall be separated from walls not less than 1/4 inch by corrosion-resistant spacers. All electrical conduits and items of equipment shall be run or set parallel to walls, floors and other items of construction.

1.2 STANDARDS

A. The Contractor shall perform work specified in Division 26 in accordance with standards listed below. Where these specifications are more stringent, the most stringent standard shall take precedence. In case of conflict, obtain a decision from the Engineer.
   1. Applicable National Fire Protection Association (NFPA) codes, including but not limited to:
      a. NFPA 70 – National Electrical Code.
      b. NFPA 70E – Standard for Electrical Safety in the Workplace.
      c. NFPA 72 - National Fire Alarm Code.
      d. NFPA 101 – Life Safety Code.
      e. NFPA 820 – Standard for Fire Protection in Wastewater Treatment and Collection Facilities.
      f. Internet Website: http://www.nfpa.org
   2. Applicable Code of Federal Regulations (CFR) codes, including but not limited to:
      a. 29 CFR 1910 – Occupational Safety and Health Standards (OSHA).
      b. 29 CFR 1926 – Safety and Health Regulations for Construction.
      c. Internet Website: http://www.gpo.gov/fdsys
   3. ANSI/IEEE C2 – National Electrical Safety Code.
   4. Applicable Federal, State and Local Fire codes.
   5. Applicable Federal, State and Local Energy Codes.
   6. Applicable Federal, State and Local Building Codes.
   7. Applicable City Electrical Code.
   8. Applicable City Ordinances pertaining to electrical work.
   9. Applicable Federal, State and Local – Environmental, Health and Safety Laws and Regulations.

B. Contractor shall utilize the most current editions of standards, which are current at time of bid and as recognized by the Authority Having Jurisdiction for the respective standard.

1.3 SUBMITTALS

A. Submittals shall comply with Section 01 33 00 SUBMITTAL PROCEDURES and the General and Supplementary Conditions.

B. Submittals shall be furnished by the Contractor for the work involved in sufficient time so that no delay or changes will be caused. Fax copies are not acceptable.

C. Submittals shall consist of manufacturing information, schematics, wiring diagrams, ladder logic diagrams, instrument loop diagrams, outline drawings, clearances and related information. Shop Drawings shall be so marked as to indicate the EXACT items offered.

D. Submittals shall bear Contractor's certification that the item complies in all respects with the item originally specified. It is the Contractor's responsibility to procure the proper sizes, quantities, rearrangements, structural modifications or other modifications in order for the substituted item to comply with the established requirements.

E. The Contractor shall combine each submittal set into one electronic file (pdf format). Group materials submitted by their Specification numbers, but do not submit the entire electrical within one submittal. Provide electronic bookmarks in the pdf to indicate the included equipment types and a title sheet to separate each section.

F. The Contractor shall submit complete descriptions, illustrations, specification data, etc., of all materials, fittings, devices, fixtures, special systems, etc., as required by the individual sections of this Division.

G. Submittal of shop drawings, product data and samples will be accepted only when submitted by the Contractor. Data submitted from subcontractors and material suppliers directly to the Engineer will not be processed.

H. All submittals shall provide the following information:
   1. General Contractor.
   2. Sub-Contractor.
   3. Distributor and/or Supplier.
   4. Sales Agency.
   5. Submittals not supplying this information will be rejected.

I. Shop Drawings: In addition to the above, submit shop drawings for major materials where called for and when requested by the Engineer.
   1. Lockout/Tagout Program.
   2. Switchboard, motor control centers, panelboards, surge arresters, and safety switches.
   3. Motor starters and contactors including custom wiring diagrams for all motors.
   4. Lighting fixtures and lamps including light pole foundation requirements.
   5. Wire, cable and conduit.
   6. Dry type transformers including weight and dimensions.
   7. Wiring devices and plates.
   8. Dimensioned layout of electrical room drawn to scale, with equipment location shown therein. Clearances shall be in accordance with NEC and local codes.
   9. Dimensioned layout of all below grade conduit installations.
   10. Grounding system and layout.
   11. Lightning protection system layout.

12. Traffic control system layout and schematics.
13. Seismic protection materials and methods for all electrical equipment.
14. Mounting brackets, supports and assembly for walkway mounted equipment including instruments, lighting and control panels

1.4 QUALITY ASSURANCE

A. Any electrical equipment provided under this Division shall be turned over to the Owner in operating condition. Instruction on further operation and maintenance shall be included in the operating and maintenance instructions.

1.5 PRODUCT LISTING

A. Prepare listing of major electrical equipment and materials for the project.

B. Provide all information requested.

C. Submit this listing as a part of the submittal requirements.

D. When two or more items of same material or equipment are required they shall be of the same manufacturer when available. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment kits, and similar items used in Work, except as otherwise indicated.

E. Provide products that are compatible within systems and other connected items.

1.6 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of power operated equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.7 WORK SUPERVISION

A. The Contractor shall designate in writing the qualified electrical supervisor who shall provide supervision to all electrical work on this project. The minimum qualifications for the electrical supervisor shall be a master electrician as defined by the statutes of the State of the work being performed. The supervisor or his appointed alternate possessing at least a master electrician license shall be on site whenever electrical work is being performed. The qualifications of the electrical supervisor shall be subject to approval of the Owner and the Engineer.

B. All master and journeyman electricians shall be licensed in accordance with the statutes of the State of the work being performed. No unlicensed electrical workers shall perform work on this project. Apprentice electricians in a ratio of not more than one apprentice per journeyman electrician will be allowed if the apprentices are licensed and actively

participating in an apprentice-ship program recognized and approved by the statutes of the State of the work being performed.

1.8 PRIMARY UTILITY SERVICE

A. The Contractor shall install all primary trenching, conduits, and backfilling for the primary service in accordance with utility requirements and utility specifications in conjunction with these plans and specifications. The Contractor shall construct concrete pads for all utility pad mount transformers in accordance with utility requirements and these plans and specifications.

B. The Contractor shall be responsible for coordinating all electrical work with the servicing utility prior to construction and providing all equipment, connectors, metering boxes and accessories to make all final connections.

1.9 SECONDARY SERVICE

A. New electrical work shall be as noted in the drawings. If required, services shall be 480Y/277 volt, three-phase, four-wire grounded as indicated. All secondary services are to be furnished and installed by the contractor.

B. The Contractor shall be responsible for coordinating all electrical work with the servicing utility prior to construction and providing all equipment, connectors, and accessories to make all final secondary connections.

C. The Contractor shall provide temporary service conductors and raceway system as may be required. The Contractor shall then provide and connect permanent service conductors and raceway system after the permanent installation. The Contractor shall coordinate temporary service, installation, metering and all other items as required with the servicing utility. The Contractor shall be responsible for paying all temporary electric monthly metering charges.

D. Service entrance electrical ducts shall be red blended concrete encased at a depth to provide 24 inches minimum cover over the top of the underground electrical duct, regardless of the soil conditions or substances encountered.

1.10 TELEPHONE WORK

A. The Contractor shall be responsible for coordinating all telephone work with the servicing utility, Owner and Engineer.

1.11 LOCKOUT / TAGOUT PROGRAM

A. The Contractor shall provide a complete copy of and electrical energy source Lockout/Tagout Program to the Owner, with copy to the Engineer. The document shall clearly identify the on-site master electricians and their contact information, including office and mobile telephone numbers.

B. The Lockout/Tagout Program shall comply with Part 1910 - Occupational Safety and Health Standards (OSHA) Subpart S – Electrical, and meet the requirements of 29 CFR 1910.147, The Control of Hazardous Energy (Lockout/Tagout), including requirements listed in 1910.331 through 1910.335.

C. Implementation of the Lockout/Tagout Program and all other related safety requirements are the sole responsibility of the Contractor.

1.12 SAFETY PROGRAM

A. The Contractor shall implement an electrical safety program that complies with NFPA 70E and 29 CFR 1926.

B. Implementation of the Electrical Safety Program, determining and providing proper Personal Protective Equipment (PPE), training and enforcing personnel to wear the prescribed PPE, conducting work area safety inspections (including correcting deficiencies), and all other related safety requirements are the sole responsibility of the Contractor.

1.13 EQUIPMENT CONNECTIONS

A. General: Provide connections for all equipment installed or modified by this contract, regardless of who furnished the equipment.

B. Provide all disconnect switches required by Code whether or not shown on the plans.

C. Contractor shall connect Owner-furnished equipment when specified.

1.14 GENERAL CONDITIONS

A. The work under this heading is subject to the General and Supplementary Conditions, special conditions for mechanical and electrical work, and the Contractor or subcontractor will be responsible for and be governed by all requirements thereunder as though specifically repeated herein.

1.15 COORDINATION

A. The Contractor shall coordinate arrangement, mounting and support of all electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at a required slope.
   4. So connecting raceways, cables and wireways will be clear of obstructions and of the working and access space of other equipment.

B. The Contractor shall coordinate electrical equipment to be mounted on vendor supplied walkways with supplier.

1.16 SPECIAL NOTE

A. The mechanical, structural and process plans and specifications, including the general conditions and all supplements issued thereto, information to bidders, and other pertinent documents issued by the Engineer, are a part of these specifications and the accompanying electrical plans, and shall be complied with in every respect. All the above is included herewith, and shall be examined by all bidders. Failure to comply shall not relieve the Contractor of responsibility or be used as a basis for additional compensation due to omission of mechanical, process and structural details from the electrical drawings.

1.17 CONTINUATION OF SERVICES

A. The Contractor shall install any temporary lines and connections required to maintain electric services and safely remove and dispose of them when complete. The Contractor shall supply emergency power whenever any existing electrical service is without power. In general, the existing facility shall remain operational during construction.

B. Planned outages shall be coordinated two weeks in advance with duration and time of start approved by the Owner. Changeover work which may be required after normal hours or weekends shall not constitute the basis for additional cost to the Owner. When an outage begins, the Contractor shall proceed directly to completion of the work without unscheduled interruptions or delays due to lack of manpower, equipment or tools.

C. The Contractor shall refer to the sequence of construction and shall provide temporary connections as may be required to complete each phase of construction as may be required. The Contractor shall submit proposed electrical service plans for each phase of construction to the Owner and Engineer for consideration.

1.18 LAYOUT

A. The Contractor shall coordinate and establish all bench marks and control lines. The Contractor shall lay out all work. The lay out shall be reviewed by the Engineer and Owner prior to starting any work.

1.19 RELATED WORK SPECIFIED ELSEWHERE

A. Mechanical Equipment: The Contractor shall rough-in for and make final electrical connections to all motor, panels, fixtures, and equipment furnished under other sections of the specifications, providing all material and equipment required for such final connections, except hereinbefore described. This includes, but is not limited to, control panels and other miscellaneous equipment.

B. The Contractor shall refer to other sections of these specifications for all information relating to the requirements of all electrical connections to the equipment and shall furnish and install electrical items required for a complete installation, ready for operation.

C. Roughing-in shall be accomplished from approved shop drawings.

D. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

E. Refer to equipment specifications in other Divisions for rough-in requirements.

1.20 LOCAL CONDITIONS

A. Inspection of Sites: The bidder shall inspect the site, thoroughly acquaint himself with conditions to be met and work to be accomplished. Failure to comply with this shall not constitute grounds for any additional payments.

1.21 RECORD DOCUMENTS

A. Refer to the General and Supplementary Conditions for requirements. The following paragraphs supplement the requirements of the General and Supplementary Conditions:
   1. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, dimensioned for column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; Change Orders; concealed control system devices.
   2. The Contractor shall locate all underground and concealed work, identifying all equipment, conduit, circuit numbers, motors, feeders, breakers, switches, and starters. The Contractor will certify accuracy by endorsement. Record drawings shall be correct in every detail, such that the Owner can properly operate, maintain, and repair exposed and concealed work.
   3. The Contractor shall store the Record drawings on the site. Drawings shall not be rolled. Make corrections, additions, etc., with pencil, with date and authorization of change.
   4. Mark specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

1.22 OPERATION AND MAINTENANCE DATA

A. Refer to Section 01 33 00, SUBMITTAL PROCEDURES and Section 01 78 23, OPERATION AND MAINTENANCE DATA for procedures and requirements for preparation and submittal of maintenance manuals.

B. In addition to the information required by Sections 01 33 00 and 01 78 23, include the following information:
   1. Installation manual: Description of function, installation and calibration manuals, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
   2. Operations manual: Manufacturer’s printed operating instructions and procedures to include start-up, break-in, routine and normal operating instructions; regulation,

control, stopping, shutdown, and emergency instructions; summer and winter operating instructions; and all programming and equipment settings.

3. Maintenance manual: Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Service manual: Servicing instructions and lubrication charts and schedules, including the names and telephone numbers of personnel to contact for both routine periodic and warranty service for equipment and materials provided under this Division.
5. Final approved equipment shop drawings, clearly labeled.
6. Final test reports, clearly labeled, including motor certification tests.
7. Final certified calibration sheets for all equipment and instruments.

C. After approval of the O&M Manuals, the Contractor shall provide three (3) complete electronic copies of all documentation in Adobe PDF file format using a storage media device of the Owner and Engineer's choosing.

1.23 GUARANTEE

A. The Contractor shall guarantee the work and materials for a period of one (1) year from the date of completion. If there are failures due to faulty material or workmanship, the Contractor shall correct the failure at no cost to the Owner.

B. Refer to the General and Supplementary Conditions for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

1. Compile and assemble the warranties specified in Division 26, into a separate set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

D. Upon completion of the installation, the Contractor shall adjust the systems to the satisfaction of the Engineer.

E. This guarantee shall include the capacity and integrated performance of the component parts of the various systems in accordance with the intent of the specifications. The Contractor shall conduct complete tests required by the Engineer to demonstrate the ability of the various systems.

1.24 CLEANING

A. Refer to Section 01 77 00 CLOSEOUT PROCEDURES for general requirements for final cleaning.

B. Clean all light fixtures, lamps and lenses prior to final acceptance. Replace all inoperative lamps.

C. The electrical system shall be thoroughly cleaned inside and outside, of all enclosures to remove all debris, dust, concrete splatter, plaster paint and lint.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. All materials and equipment used in carrying out these specifications shall be new and have UL listing, or listing by other recognized testing laboratory when such listings are available. Specifications and drawings indicate name, type, or catalog numbers of materials and equipment to be used as standards.

2.2 HEAT TRACING

A. Heat trace and insulate all exposed piping, water lines, and valves less than 8" diameter and all equipment where water may collect. Where exact sizes, panels, boxes, conduit, circuitry and other items of construction are shown or required for a complete installation, but are not adequately identified as to size or material requirements, the materials furnished shall be as needed to provide freeze protection requirements as though shown in detail on the Drawings. The Contractor shall be responsible for supplying all items as required for complete heat tracing systems regardless of the level of detail shown on the Drawings.

B. Contractor shall meet all National Electrical code requirements for heat tracing and particularly to Resistance Heating Elements Article 427-21, 22 and 23.

PART 3 - EXECUTION

3.1 SALVAGE

A. All salvage and equipment removed by the work shall remain the property of the Owner unless directed otherwise by the Owner. Material removed from the project shall be stored on the project site where and as directed. Debris shall be removed from the job site and disposed of by the Contractor.

3.2 DEMOLITION AND DISPOSAL

A. All conduit, wire, and other electrical appurtenances associated with equipment removed in this project, and no longer in use, shall be removed and stored or disposed of as directed by the Owner. The Contractor shall patch and apply finish to walls, floors, and other structures from which such items are removed to match surrounding colors, textures, or other visual characteristics.

3.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Equipment and materials shall be stored in accordance with the manufacturer's recommendations and instructions.

D. All equipment, including but not limited to equipment containing coils and/or electronics, shall be stored in a clean, dry, ventilated and heated building. The storage area shall be free from condensation or other injurious environmental conditions. Freedom from condensation shall be essential and shall be accomplished by the use of auxiliary heaters as required to raise the temperature to 5-degree C above the ambient temperature. The equipment shall be protected from excessive dust.

E. In addition, certain electronic equipment that requires cooling based upon its specific storage temperature range shall be stored in an air-conditioned building.

F. All motors shall be stored in a clean, dry, ventilated and heated building. The storage area shall be free from condensation or other injurious environmental conditions. Freedom from condensation shall be essential and shall be accomplished by the use of auxiliary heaters as required to raise the temperature to 5 degree C above the ambient temperature. The motors shall be protected from excessive dust.

G. Cables and wiring shall be kept in a dry location out of the sun.

H. Outdoor storage, even when protected by a tarpaulin, is unacceptable.

I. Equipment may be rejected if the storage criteria are not followed.

3.4 INSTALLATION

A. Coordinate electrical equipment and materials installation with other building components.

B. Verify all dimensions by field measurements.

C. Arrange for chases, slots, and openings in other building components to allow for electrical installations.

D. The Contractor shall keep ends of conduits, including those extending through roofs, equipment and fixtures covered or closed with caps or plugs to prevent foreign material from entering during construction.

E. Coordinate the installation of required supporting devices and sleeves to be set in concrete and other structural components as they are constructed.

F. Sequence, coordinate, and integrate installations of electrical materials and equipment for maintaining the required operation of the facility. Give particular attention to large equipment requiring positioning prior to closing-in the building.

G. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.

H. Where mounting heights are not detailed or dimensioned, install electrical services and overhead equipment to provide the maximum headroom possible.

I. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

J. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.

K. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

L. Coordinate installation of electrical equipment on vendor supplied walkways with supplier.

3.5 MATERIALS AND WORKMANSHIP

A. All materials shall be new, and shall be of the latest standard design of a manufacturer regularly engaged in the manufacture of that type of equipment. Materials shall be in good condition and shall be free from dents, scratches or other damage incurred in shipment or installation.

B. All equipment shall comply with the National Electrical Code, Underwriters Laboratories or other appropriate agency.

C. Installation shall be made in a neat and workmanlike manner, and all materials shall be installed in accordance with the recommendations of the various manufacturers. The installation shall be subject to the approval of the Owner and Engineer.

D. Incidental materials required to complete the installation as intended by these Specifications shall be of the type and quality in keeping with specified equipment.

3.6 COORDINATION

A. Carefully examine specification and drawings to be thoroughly familiar with items which require electrical connections and coordination. (Electrical drawings are diagrammatic and shall not be scaled for exact sizes.)

B. Notify other tradesmen of any deviations or special conditions necessary for the installation of work. Interference between work of various contractors shall be resolved prior to installation. Work installed not in compliance with specifications and drawings and without properly checking and coordinating as specified above shall, if necessary, be removed and properly reinstalled without additional cost to the Owner. Engineer to be mediating authority in all disputes arising on project.

C. Equipment shall be installed in accordance with manufacturer's recommendation. Where conflicts occur between contract documents and these recommendations, a ruling shall be requested of the Engineer for decision before proceeding with such work.

3.7 CUTTING AND PATCHING

A. Repair or replace routine damage caused by cutting in performance of work under this Division.

B. Correct unnecessary damage caused due to installation of electrical work, brought about through carelessness or lack of coordination.

C. Holes cut through floor slabs to be sleeved or core drilled with drill designed for this purpose. All openings, sleeves, and holes in slabs to be properly sealed, fire proofed and water proofed.

D. Repairs to be performed with materials which match existing materials and to be installed in accordance with appropriate sections of these specifications.

E. All cutting and patching work shall be coordinated in advance with the Engineer and Owner prior to any work.

3.8 TRENCHING, EXCAVATION, BACKFILLING, AND REPAIRS

A. Provide trenching, excavation, and backfilling necessary for performance of work under this Division.

3.9 FOUNDATIONS AND PADS

A. Foundations and pads required for equipment shall be provided as indicated. Proper size and location of foundations, pads and anchor bolts shall be determined under this Division.

B. Provide anchors and bases for electrical equipment to withstand lateral forces and accommodate displacements.

3.10 NOISE AND VIBRATION CONTROL

A. The electrical system as installed shall be free of objectionable noise or vibration. The Contractor shall isolate motors, starters, transformers, equipment, ballasts, etc., as directed or required as to ensure acceptable noise level free from objectionable vibration in all systems.

3.11 TESTS

A. On completion of work, installation shall be completely operational and entirely free from ground, short circuits, and open circuits. Perform a thorough operational test in presence of the Owner and Engineer. Furnish all labor, materials and instruments for above tests.

B. Furnish the Engineer, as part of closing file, a copy of such tests including identification of each circuit and readings recorded. Test information to be furnished to the Engineer includes ampere readings of all panels and major circuit breakers, isolation resistance reading of motors and transformers.

C. Prior to final observation and acceptance test, all electrical systems and equipment shall be in satisfactory operating condition. Including, but not limited to the following:
   1. Electrical power and distribution system.
   2. Lighting systems.
   3. Transformers.
   4. Electric motors for all equipment.
   5. Telecommunication system.
   6. Emergency power system.
   7. Special electrical control systems.

D. After installation of the electrical system and before operating equipment, functional checking shall be conducted in accordance with the manufacturer's recommendations, with the contract drawings and as follows:
   1. Functional checking shall include inspection, testing and repair, replacement or adjustments as necessary to ensure compliance with the requirements of the specifications. Tests and inspections shall be recorded on appropriate yellow lined contract and shop drawings, standard test forms and checklists to indicate that wiring and controls are in place in accordance with requirements and to form the basis of record drawings.
   2. The functional test procedures shall be signed and dated by the Contractor and presented to the Owner's construction observation personnel prior to operating any equipment.
      a. Visual Inspection – The electrical system shall be examined as outlined below:

Parts of components missing
Improper assembly
Parts or components not functioning properly
Finish not as specified
Materials not as specified

Connections not tight
Mounting and supports loose or unsatisfactory
Nameplates missing or inaccurate

b. Grounding System Tests

Measure the resistance of the counterpoise grounding system by the rate-of-fall of potential method. Record all measurements on an approved standard test form made specifically for the purpose. The resistance of the grounding system to ground shall not exceed NFPA 70 requirements.

c. Continuity Tests

Each wire and each wire in each cable rated 300 volts and below shall be tested for continuity. Record wire number and pass or fail on checklist for each wire.

d. Dielectric Tests

Each power conductor rated 600 volts and above shall be tested (meggered) for dielectric strength to ground.

Prior to testing, all components that could be damaged should be disconnected. After testing, the circuit shall still register a resistance value of not less than 1 megohm at 600 volts, dc. This test shall apply between all insulated circuits and external metal parts. Record equipment name, phase or wire number and all observed values for each wire.

Subsequent to wire and cable hook-ups, energize circuits and demonstrate proper functioning of all circuits. Record equipment or circuit number and pass or fail on function test checklist for each circuit.

The Contractor shall develop non-conforming material reports for each failure. Repair and report failures all failures to Owner and Engineer.

The Contractor shall replace defective parts, correct malfunctioning units, make all repairs and retest to demonstrate compliance. The Contractor shall document all actions taken on appropriate non-conforming material report.

3.12 INSPECTION FEES AND PERMITS

A. Obtain and pay for all necessary permits and inspection fees required for electrical installation.

3.13 IDENTIFICATION OF EQUIPMENT

A. Properly identify all electrical equipment, including but not limited to the following:
   1. Switchgear, switchboards, motor control centers, and control panels.
   2. Main distribution panel and individual devices within it.
   3. Panelboards and individual devices within it.
   4. Safety switches and disconnects.
   5. Contactors and lighting control center, including all branch circuits.
   6. Individually mounted circuit breakers.
   7. Relays.
   8. Transformers.
   9. Generators and automatic transfer switches.
   10. Any other type of enclosure that includes electrical equipment.

3.14 TEMPORARY LIGHTS AND POWER

A. Provide a temporary electrical lighting and power distribution system of adequate size to properly serve the construction needs, including adequate feeder sizes to prevent excessive voltage drop. Temporary work to be installed in a neat and safe manner in accordance with the National Electrical Code, Article 590, and as required by OSHA or applicable local safety codes.

B. Provide service and panelboards required for lighting and power outlets.

C. The Contractor will pay for power consumption.

D. Coordinate prior to installation to determine whether single phase or three-phase temporary service is desired.

END OF SECTION

SECTION 26 05 01
ELECTRICAL

PART 1 GENERAL

1.01 SUMMARY

A. This section details basic electrical materials and methods for small residential and commercial pump station Projects.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway Transportation Officials (AASHTO).
2. ASTM International (ASTM):
   a. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   b. A240/A240M, Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
   c. A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   d. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
   e. C857, Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
3. Electronic Industries Association (EIA/TIA): 569, Commercial Building Standard for Telecommunications Pathways and Spaces.
4. Federal Specifications (FS):
   a. W-C-596, Connector, Electrical, Power, General Specification for.
   b. W-S-896, Switch, Toggle (Toggle and Lock), Flush Mounted (General Specification).
5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
   b. PC62.41.1, Draft Guide on the Surge Environment in Low-Voltage (1,000V and less) AC Power Circuits.
   c. 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
   d. 114, Standard Test Procedures for Single-Phase Induction Motors.
6. International Electrical Testing Association (NETA): ATS, Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

7. National Electrical Contractor's Association, Inc. (NECA): 1, Standard Practices for Good Workmanship in Electrical Contracting.
8. National Electrical Manufacturers Association (NEMA):
    a. C80.1, Rigid Steel Conduit-Zinc Coated.
    b. C80.3, Electrical Metallic Tubing-Zinc Coated.
    c. C80.6, Intermediate Metal Conduit-Zinc Coated (IMC).
    d. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
    e. CC1, Electrical Power Connectors for Substations.
    f. ICS 1, Industrial Control and Systems: General Requirements.
    g. ICS 2, Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC.
    h. ICS 2.3, Industrial Control and Systems: Instructions for the Handling, Installation, Operation and Maintenance of Motor Control Centers.
    i. MG 1, Motors and Generators.
    j. PB 1, Panelboards.
    k. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
    l. ST 20, Dry Type Transformers for General Applications.
    m. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
    n. TC 3, PVC Fittings for Use with Rigid PVC Conduit and Tubing.
    o. WC 55, Instrumentation Cables and Thermocouple Wire.
    p. WC 70, Standard for Non-Shielded Power Cables Rated 2000 V or Less for the Distribution of Electrical Energy.
    q. WC 71, Standard for Non-Shielded Cables Rated 2001-5000 Volts for use in the Distribution of Electrical Energy.
    r. WC 74, 5-46 KV Shielded Power Cable for use in the Transmission and Distribution of Electric Energy.
    s. WD 1, General Color Requirements for Wiring Devices.
9. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
10. Underwriters Laboratories, Inc. (UL):
    a. 1, Flexible Metal Conduit.
    b. 6, Electrical Rigid Metal Conduit—Steel.
    c. 13, Power-Limited Circuit Cables.
    d. 44, Thermoset Insulated Wires and Cables.
    e. 62, Flexible Cord and Fixture Wire.
    f. 67, Panelboards.
    g. 98, Enclosed and Dead-Front Switches.
    h. 198C, High Interrupting Capacity Fuses, Current Limiting Types.
    i. 198E, Class R Fuses.
    j. 360, Liquid-Tight Flexible Steel Conduit.
    k. 486A, Wire Connectors and Soldering Lugs for Use with Copper Conductors.
    l. 486C, Splicing Wire Connectors.

m. 489, Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
n. 508, Industrial Control Equipment.
o. 510, Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
p. 514B, Fittings for Cable and Conduit.
q. 651, Schedule 40 and 80 PVC Conduit.
r. 674, Electric Motors And Generators for use in Division 1 Hazardous (Classified) Locations.
s. 797, Electrical Metallic Tubing.
t. 854, Service-Entrance Cables.
u. 870, Wireways, Auxiliary Gutters, and Associated Fittings.
v. 943, Ground-Fault Circuit Interrupters.
w. 1059, Terminal Blocks.
x. 1242, Intermediate Metal Conduit.
y. 1277, Electrical Power and Control Tray Cables with Optional Optical-Fibre Members.
z. 1449, Transient Voltage Surge Suppressors.
aa. 1561, Dry-Type General Purpose and Power Transformers.
bb. 2111, Overheating Protection for Motors.

1.03 DEFINITIONS

A. AHJ: Authority Having Jurisdiction.

B. MCOV: Maximum Allowable Continuous Operating Voltage.

C. MOV: Metal Oxide Varistor.

D. SASD: Silicon Avalanche Suppressor Diode.

E. SVR: Surge Voltage Rating.

F. TVSS: Transient Voltage Surge Suppressor.

1.04 APPROVAL BY AUTHORITY HAVING JURISDICTION

A. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the Authority Having Jurisdiction (AHJ), material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ, in order to provide a basis for approval under the NEC.

B. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark or label.

PART 2 PRODUCTS

2.01 GENERAL

A. Products shall comply with all applicable provisions of NFPA 70.

B. Equipment and Devices Installed Outdoors or in Unheated Enclosures: Capable of continuous operation within ambient temperature range of 0 degrees F to 104 degrees F.

C. Hazardous Areas: Products shall be acceptable to the regulatory authority having jurisdiction for the class, division, and group of hazardous area indicated.

D. Equipment Finish: Manufacturer's standard finish color, except where specific color is indicated.

2.02 SERVICE ENTRANCE EQUIPMENT AND METERING

A. Equipment, installation arrangement, and scope of work shall be provided in accordance with requirements of the local electric utility.

2.03 OUTLET AND DEVICE BOXES

A. Cast Metal:

1. Box: Cast ferrous metal.
2. Cover: Gasketed, weatherproof, and cast ferrous metal with stainless steel screws.
3. Hubs: Threaded.
4. Lugs: Cast Mounting.
5. Manufacturers and Products, Nonhazardous Locations:
   a. Crouse-Hinds; Type FS or FD.
   b. Appleton; Type FS or FD.
6. Manufacturers and Products, Hazardous Locations:
   a. Crouse-Hinds; Type GUA or EAJ.
   b. Appleton; Type GR.

B. PVC-Coated Cast Metal:

1. Type: One-piece.
2. Material: Malleable iron, cast ferrous metal, or cast aluminum.
3. Coating:
   a. All Exterior Surfaces; 40 mils PVC.
   b. All Interior Surfaces, 2 mils urethane.

4. Manufacturers:
    a. Robroy Industries.
    b. Ocal.

2.04 JUNCTION AND PULL BOXES

A. Large Cast Metal Box, Hazardous Locations:

1. NEMA 250, Type 7 or 9 as required for Class, Division, and Group involved.
2. Box: Cast ferrous metal, electro-galvanize finished, or copper-free aluminum with drilled and tapped conduit entrances.
3. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
4. Manufacturers and Products:
    a. Crouse-Hinds; Type EJB.
    b. Appleton; Type EJB.

B. Large Stainless Steel Box:

1. NEMA 250, Type 4X.
2. Box: 14-gauge, ASTM A240, Type 304 stainless steel.
3. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
4. Manufacturers:
    a. Hoffman Engineering Co.
    b. Robroy Industries.

C. Concrete Box, Nontraffic Areas:

1. Box: Reinforced, cast concrete with extension.
2. Cover: Steel diamond plate with locking bolts.
3. Cover Marking: ELECTRICAL, TELEPHONE, or as shown.
4. Size: 10 inch by 17 inch (minimum).
5. Manufacturer and Product: Utility Vault Co.; Series 36-1017PB, with cover DP.

2.05 WIRING DEVICES

A. Switches:

1. NEMA WD 1 and FS W-S-896.
2. Industrial grade, totally enclosed, ac type, with quiet tumbler switches and screw terminals.
3. Capable of controlling 100 percent tungsten filament and fluorescent lamp loads.
4. Rating: 20 amps, 120/277 volts.
5. Automatic grounding clip and integral grounding terminal on mounting strap.

6. Manufacturers and Products:
    a. Leviton; 1221 Series.
    b. Bryant; 4901 Series.
    c. Hubbell; 1221 Series.

B. Receptacle, Single and Duplex:

1. NEMA WD 1 and FS W-C-596.
2. Specification grade, two-pole, three-wire grounding type with screw type wire terminals suitable for No. 10 AWG.
3. High strength, thermoplastic base color.
4. Contact Arrangement: Contact to be made on two sides of each inserted blade without detent.
5. Rating: 125 volts, NEMA WD 1, Configuration 5-20R, 20 amps.
6. One-piece mounting strap with integral ground contact (rivetless construction).
7. Manufacturers and Products:
    a. Arrow Hart; 5262 Series.
    b. Leviton; 5262/5362 Series.
    c. Bryant; 5262/5362 Series.
    d. Hubbell; 5262/5362 Series.

C. Receptacle, Ground Fault Circuit Interrupter:

1. Duplex, listed Class A to UL Standard 943, tripping at 5 mA.
2. Rating: 125 volts, NEMA WD 1, Configuration 5-20R, 20 amps.
3. Size: For 2-inch by 4-inch outlet boxes.
4. Impact resistant nylon face.
5. Manufacturers:
    a. Bryant.
    b. Hubbell.
    c. Leviton.

2.06 DEVICE PLATES

A. General: Sectional type plates not permitted.

B. Metal:

1. Material: Specification grade, one-piece, 0.040-inch nominal thickness stainless steel.
2. Finish: ASTM A167, Type 302/304, satin.
3. Mounting Screw: Oval-head, finish matched to plate.

C. Cast Metal:

1. Material: Malleable ferrous metal or copper-free aluminum, with gaskets.

2. Screw: Oval-head stainless steel.

D. Weatherproof:

1. For Receptacles, Wet Locations:
   a. Impact-resistant, nonmetallic, single-gang, horizontal-mounting, providing, while in-use, NEMA 3R rating.
   b. Stainless steel mounting and hinge hardware.
   c. Lockable, paintable.
   d. Color: Gray.
   e. Manufacturers:
      1) Carlon.
      2) Leviton.
2. For Switches:
   a. Gasketed, cast-metal or cast-aluminum, incorporating external operator for internal switch.
   b. Mounting Screw: Stainless steel.
   c. Manufacturers and Products:
      1) Crouse-Hinds; DS-181 or DS-185.
      2) Appleton; FSK-1VTS or FSK-1VS.

2.07 LIGHTING AND POWER DISTRIBUTION PANELBOARD

A. NEMA PB 1, NFPA 70, and UL 67.

B. Panelboards and Circuit Breakers: Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.

C. Short-Circuit Current Equipment Rating: Fully rated; series connected unacceptable.

D. Cabinet:

1. NEMA 250, Type 3R.
2. Material: Code-gauge, hot-dip galvanized sheet steel with reinforced steel frame.
3. Wiring Gutter: Minimum 4-inch square; both sides, top and bottom.
4. Front: Fastened with adjustable clamps.
   a. Trim Size: As required by mounting.
   b. Finish: Manufacturer’s standard.
5. Interior:
   a. Factory assembled; complete with circuit breakers.
   b. Spaces: Cover openings with easily removable metal cover.
6. Door Hinges: Concealed.
7. Locking Device:
   a. Flush type.
   b. Doors Over 30 Inches in Height: Multipoint.
   c. Identical keylocks, with two milled keys each lock.

8. Circuit Directory: Metal frame with transparent plastic face and enclosed card on interior of door.

E. Bus Bar:

1. Material: Copper full sized throughout length.
2. Neutral: Insulated, rated same as phase bus bars with at least one terminal screw for each branch circuit.
3. Ground: Copper, installed on panelboard frame, bonded to box with at least one terminal screw for each circuit.
4. Lugs and Connection Points:
   a. Suitable for either copper or aluminum conductors.
   b. Solderless main lugs for main, neutral, and ground bus bars.
   c. Subfeed or through-feed lugs as shown.

F. Circuit Breakers:

1. UL 489.
2. Thermal-magnetic, quick-make, quick-break, molded case, of indicating type showing ON/OFF and TRIPPED positions of operating handle.
3. Type: Bolt-on circuit breakers in all panelboards.
4. Multipole circuit breakers designed to automatically open all poles when an overload occurs on one pole.
5. Do not use tandem or dual circuit breakers in normal single-pole spaces.
6. Ground Fault Circuit Interrupter (GFCI): UL Class A GFCI, 5 mA trip, and 10,000 amps interrupting capacity circuit breakers.
7. Ground Fault Equipment Protector (GFEP): 30 mA trip, 10,000 amps interrupting capacity circuit breaker, and UL listed for equipment ground fault protection.

G. Manufacturers:

1. Eaton.
2. General Electric Co.
3. Square D Co.

2.08 MINI-POWER CENTER (MPC)

A. General: Transformer, primary and secondary main circuit breakers, and secondary panelboard section enclosed in NEMA 250, Type 3R enclosure.

B. Transformer:

1. Type: Dry, self-cooled, encapsulated.
2. Insulation: Manufacturer’s standard, with UL 1561 temperature rise.
3. Full capacity, 2-1/2 percent voltage taps, two above and two below normal voltage.

C. Panelboard: UL 489, fully-rated.

1. Type: Thermal-magnetic, quick-make, quick-break, indicating, with noninterchangeable molded case circuit breakers.
2. Number and Breaker Ampere Ratings: Refer to Panelboard Schedule.

D. Manufacturers:

1. Eaton.
2. General Electric Co.
3. Square D Co.

2.09 CIRCUIT BREAKER, INDIVIDUAL, 0 TO 600 VOLTS

A. UL 489 listed for use at location of installation.

B. Thermal-magnetic, quick-make, quick-break, indicating type showing ON/OFF and TRIPPED indicating positions of operating handle.

C. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.

D. Locking: Provisions for padlocking handle.

E. Enclosure: As specified under Execution.

F. Interlock: Enclosure and switch shall interlock to prevent opening cover with breaker in the ON position.

G. Manufacturers:

1. Eaton.
2. General Electric Co.
3. Square D Co.

2.10 FUSED SWITCH, INDIVIDUAL, 0 TO 600 VOLTS

A. UL 98 listed for use and location of installation.

B. NEMA KS 1 and UL 98 Listed for application to system for available short-circuit current.

C. Quick-make, quick-break, motor rated, load-break, heavy-duty (HD) type with external markings clearly indicating ON/OFF positions.

D. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.

E. Fuse mountings shall reject Class H fuses and accept only current-limiting fuses specified.

F. Enclosure: As specified under Execution.

G. Interlock: Enclosure and switch to prevent opening cover with switch in ON position.

H. Manufacturers:

1. Eaton.
2. General Electric Co.
3. Square D Co.

2.11 NONFUSED SWITCH, INDIVIDUAL, 0 TO 600 VOLTS

A. NEMA KS 1.

B. Quick-make, quick-break, motor rated, load-break, heavy-duty (HD) type with external markings clearly indicating ON/OFF positions.

C. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.

D. Enclosure: As specified under Execution.

E. Interlock: Enclosure and switch to prevent opening cover with switch in the ON position.

F. Manufacturers:

1. Eaton.
2. General Electric Co.
3. Square D Co.

2.12 FUSE, 0 TO 600 VOLTS

A. Current-limiting, with 200,000 ampere rms interrupting rating.

B. Provide to fit mountings specified with switches and features to reject Class H fuses.

C. Motor and Transformer Circuits, 0 to 600 Volt:

1. Amperage: 0 to 600.
2. UL 198E, Class RK-1, dual element, with time delay.
3. Manufacturers and Products:
   a. Bussmann; Type LPS-RK.
   b. Littelfuse, Inc.; Type LLS-RK.

D. Feeder and Service Circuits, 0 to 600 Volt:

1. Amperage: 0 to 600.
2. UL 198E, Class RK-1, dual element, with time delay.
3. Manufacturers and Products:
   a. Bussmann; Type LPS-RK.
   b. Littelfuse, Inc.; Type LLS-RK.

E. Feeder and Service Circuits, 0 to 600 Volt:

1. Amperage: 601 to 6,000.
2. UL 198C, Class L, double O-rings and silver links.
3. Manufacturers and Products:
   a. Bussmann; Type KRP-C.
   b. Littelfuse, Inc.; Type KLPC.

2.13 PUSHBUTTONS, INDICATING LIGHTS, AND SELECTOR SWITCHES

A. Type: Heavy-duty, oiltight. Provide contact arrangements, colors, inscriptions, and functions as shown.

B. Contact Rating: NEMA ICS 2, Type A600.

C. Unless otherwise shown, provide the following features:

1. Selector Switch Operating Lever: Standard.
2. Indicating Lights: Push-to-test, transformer-type.
3. Pushbutton Color:
   a. ON or START: Black.
   b. OFF or STOP: Red.
4. Pushbuttons and selector switches lockable in OFF position where indicated.

D. Legend Plate:

1. Material: Aluminum.
2. Engraving: Indicating specific function, or as shown.
3. Letter Height: 7/64 inch.

E. Manufacturers and Products:

1. General Electric Co.; Type CR 104P.
2. Square D Co.; Type T.
3. Eaton; Type 10250T.

2.14 TERMINAL BLOCKS

A. Type: UL 1059. Compression screw clamp, with current bar providing direct contact with wire and yoke, with individual rail mounted terminals. Marking system shall permit use of preprinted or field-marked tags.

B. Yokes and Clamping Screws: Zinc-plated, hardened steel.

C. Rating: 600V ac.

D. Manufacturers:

1. Weidmuller, Inc.
2. Ideal.

2.15 MAGNETIC CONTROL RELAYS

A. NEMA ICS 2, Class A600 (600 volts, 10 amperes continuous, 7,200VA make, 720VA break), machine tool type with field convertible contacts.

B. Manufacturer and Model:

1. Eaton; Type M-600.
2. General Electric; Type CR120B.

2.16 TIME DELAY RELAY

A. Industrial Relay Rated: 150 volts, 5 amps continuous, (3600 VA make, 360 VA break).

B. Solid-state electronic, field convertible ON/OFF delay.

C. Two Form-C contacts (minimum).

D. Repeat accuracy plus or minus 2 percent.

E. Timer Adjustment: Multiple adjustable ranges, including 1 second to 60 seconds, unless otherwise shown.

F. Manufacturers:

1. Omron.
2. Eaton.
3. General Electric Co.

2.17 PHASE MONITOR RELAY

A. Voltage and phase monitor relay shall drop out on low voltage, voltage unbalance, loss of phase, or phase reversal.

B. Contacts: Single-pole, double-throw, 10 amperes, 120/240V ac. Where additional contacts are shown or required, provide magnetic control relays.

C. Adjustable trip and time delay settings.

D. Transient Protection: 1,000V ac.

E. Mounting: 8 pin round.

F. Manufacturer and Product: Diversified Electronics, SLA440ASA or SLA220ASA.

2.18 DRY TYPE POWER TRANSFORMERS (0- TO 600-VOLT PRIMARY)

A. Type: Self-cooled, two-winding.

B. UL 1561 and NEMA ST 20.

C. Insulation Class, Temperature Rise, and Impedance: Manufacturer’s standard.

D. Core and Coil:

1. 30 kVA or Less: Encapsulated.
2. 37.5 kVA and Larger: Varnish impregnated.

E. Enclosure:

1. 30 kVA or Less: NEMA 250, Type 3R, nonventilated.
2. 37.5 kVA and Larger: NEMA 250, Type 2, ventilated.

F. Voltage Taps: Full capacity, 2-1/2 percent, two above and two below normal voltage rating.

G. Sound Level: Not to exceed NEMA ST 20 levels.

H. Vibration isolators to minimize and isolate sound transmission.

I. Manufacturers:

1. General Electric.
2. Eaton.
3. Square D.

2.19 SUPPORT AND FRAMING CHANNELS

A. Stainless Steel Framing Channel: Rolled, ASTM A167, Type 316 stainless steel, 12-gauge.

B. Manufacturers:

1. B-Line Systems, Inc.
2. Unistrut Corp.

2.20 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) EQUIPMENT

A. General:

1. Units shall be suitable for the service voltage and configuration (phases and wires) shown.
2. Protection Modes:
   a. Normal, differential, and common.
   b. Bipolar or bi-directional.
3. Ratings: Short-circuit current rating shall equal or exceed that of protected distribution equipment. Surge Voltage Rating (SVR) shall not exceed those specified under UL 1449 for the associated nominal system voltage. Maximum Allowable Continuous Operating Voltage (MCOV) shall be at least 115 percent of the nominal system voltage.
4. Unit shall be UL-listed.
5. Provide status indicators for unit ON-LINE and unit operation NORMAL.
6. Provide common alarm contact output.
7. Provide fusible disconnect switch (integral with TVSS unit, where available) where not shown connected via branch circuit device of protected distribution equipment.
8. Minimum Enclosure Rating: NEMA 250, Type 2. Provide Type 4/4X for outdoor or wet locations.

B. Type 1 TVSS:

1. Requirements: High surge current device designed for location/exposure Category C3, per IEEE C62.41. Provide surge current rating per phase as shown. Unit shall utilize symmetrically balanced Metal Oxide Varistor (MOV) technology.
2. Manufacturer and Product: Transtector; Model Aegis SP.

C. Type 2 TVSS:

1. Requirements: Designed for critical loads at service equipment (Category C3/B3) or distribution panelboard (Category C2/B3) locations. Unit shall utilize voltage-matched Silicon Avalanche Suppressor Diode (SASD) technology. Unit shall utilize modular, plug-in suppressor design.
2. Manufacturer and Product: Transtector; Model Apex III (nonservice entrance distribution panelboard) or Apex IV (service equipment).

D. Type 3 TVSS:

1. Requirements: Designed for noncritical loads at distribution panelboards with location/exposure Category C3. Unit shall utilize symmetrically balanced Metal Oxide Varistor (MOV) technology. Unit shall utilize modular, plug-in suppressor design.
2. Manufacturer and Product: Transtector; Model SPD.

2.21 CONDUIT AND FITTINGS

A. Rigid Aluminum Conduit:

1. Rigid Aluminum Conduit of 6063 alloy in temper designation T-1. The fittings are of the same alloy. Provide threaded Rigid Aluminum Conduit to Underwriters Laboratories U.L. 6A, Standard for Electrical Rigid Metal Conduit and manufactured to ANSI C80.5.
2. Provide threaded aluminum conduit fittings, of 6063 alloy, cast copper free aluminum with integral insulated throat as manufactured by Allied, OZ Gedney, T&B, Crouse-Hinds, Killark or Appleton.
3. Provide supplementary corrosion protection for aluminum conduit imbedded in concrete or in contact with soil. Where aluminum conduits are in contact with or penetrate concrete, coast conduit with asphaltic or bitumastic type coating.

B. PVC-Coated Rigid Galvanized Steel Conduit:

1. Meet requirements of NEMA RN 1.
2. Material:
   a. Meet requirements of NEMA C80.1 and UL 6.
   b. Exterior Finish: PVC coating, 40 mils nominal thickness, bond to metal shall have tensile strength greater than PVC.
   c. Interior Finish: Urethane coating, 2 mils nominal thickness.
3. Threads: Hot-dipped galvanized and factory coated with urethane.
4. Bendable without damage to either interior or exterior coating.

C. Flexible Metal, Liquid-Tight Conduit:

1. UL 360 listed for 105 degrees C insulated conductors.
2. Material: Galvanized steel, with an extruded PVC jacket.

D. Flexible Coupling, Hazardous Locations:

1. Approved for use in the atmosphere involved.
2. Rating: Watertight and UL listed for use in Class I, Division 1 and Division 2 areas.
3. Outer bronze braid and an insulating liner.
4. Conductivity equal to a similar length of rigid metal conduit.
5. Manufacturers and Products:
    a. Crouse-Hinds; Type ECGJH or ECLK.
    b. Appleton; EXGJH or EXLK.

E. Fittings:

1. Provide bushings, grounding bushings, conduit hubs, conduit bodies, couplings, unions, conduit sealing fittings, drain seals, drain/breather fittings, expansion fittings, and cable sealing fittings, as applicable.
2. Rigid Galvanized Steel Conduit:
    a. Meet requirements of UL 514B.
    b. Type: Threaded, galvanized.
3. PVC-Coated Rigid Galvanized Steel Conduit:
    a. Meet requirements of UL 514B.
    b. Fittings: Rigid galvanized steel type, PVC-coated by conduit manufacturer.
    c. Conduit Bodies: Cast metal hot-dipped galvanized or urethane finish. Cover shall be of same material as conduit body. PVC-coated by conduit manufacturer.
    d. Finish: 40-mil PVC exterior, 2-mil urethane interior.
    e. Overlapping pressure sealing sleeves.
    f. Conduit Hangers, Attachments, and Accessories: PVC-coated.
    g. Manufacturers:
        1) Robroy Industries.
        2) Ocal.
    h. Expansion Fitting Manufacturer and Product: Ocal; Ocal-Blue XJG.
4. Flexible Metal, Liquid-Tight Conduit:
    a. Metal insulated throat connectors with integral nylon or plastic bushing rated for 105 degrees C.
    b. Insulated throat and sealing O-rings.
5. Flexible Coupling, Hazardous Locations:
    a. Approved for use in the atmosphere involved.
    b. Rating: Watertight and UL listed for use in Class I, Division 1 and Division 2 areas.

c. Outer bronze braid and an insulating liner.
d. Conductivity equal to a similar length of rigid metal conduit.
e. Manufacturers and Products:
1) Crouse-Hinds; Type ECGJH or ECLK.
2) Appleton; EXGJH or EXLK.

2.22 CONDUCTORS AND CABLES

A. Conductors 600 Volts and Below:

1. Conform to applicable requirements of NEMA WC 71, WC 72, and WC 74.
2. Conductor Type:
a. 120- and 277-Volt Lighting, No. 10 AWG and Smaller: Solid copper.
b. 120-Volt Receptacle Circuits, No. 10 AWG and Smaller: Solid copper.
3. Insulation: Type THHN/THWN, except for sizes No. 6 and larger, with XHHW-2 insulation.
4. Direct Burial and Aerial Conductors and Cables:
a. Type USE/RHH/RHW insulation, UL 854 listed or Type RHW-2/USE-2.
b. Conform to physical and minimum thickness requirements of NEMA WC 70.
5. Flexible Cords and Cables:
a. Type SOW-A/50 with ethylene propylene rubber insulation in accordance with UL 62.
b. Conform to physical and minimum thickness requirements of NEMA WC 70.

B. 600-Volt Rated Cable:

1. General:
a. Type TC, meeting requirements of UL 1277, including Vertical Tray Flame Test at 20,000 Btu per hour, and NFPA 70, Article 340, or UL 13 meeting requirements of NFPA 70, Article 725.
b. Permanently and legibly marked with manufacturer’s name, maximum working voltage for which cable was tested, type of cable, and UL listing mark.
c. Suitable for installation in open air, in cable trays, or conduit.
d. Minimum Temperature Rating: 90 degrees C dry locations, 75 degrees C wet locations.
e. Overall Outer Jacket: PVC, flame-retardant, sunlight- and oil-resistant.
2. Type TSP, No. 16 AWG, Twisted, Shielded Pair, Instrumentation Cable: Single pair, designed for noise rejection for process control,

computer, or data log applications meeting NEMA WC 55 requirements.

a. Outer Jacket: 45 mils nominal thickness.
b. Individual Pair Shield: 1.35 mils, double-faced aluminum/synthetic polymer overlapped to provide 100 percent coverage.
c. Dimension: 0.31-inch nominal outside diameter.
d. Conductors:
    1) Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
    2) 20 AWG, seven-strand tinned copper drain wire.
    3) Insulation: 15 mils nominal PVC.
    4) Jacket: 4 mils nominal nylon.
    5) Color Code: Pair conductors black and red.
e. Manufacturers: Okonite Co.

C. Accessories:

1. Tape:
    a. General Purpose, Flame Retardant: 7 mils, vinyl plastic, Scotch Brand 33, rated for 90 degrees C minimum, meeting requirements of UL 510.
    b. Flame Retardant, Cold and Weather Resistant: 8.5 mils, vinyl plastic, Scotch Brand 88.
    c. Arc and Fireproofing:
        1) 30 mils, elastomer.
        2) Manufacturers and Products:
            a) 3M; Scotch Brand 77, with Scotch Brand 69 glass cloth tapebinder.
            b) Plymount; Plyarc 53, with Plyglas 77 glass cloth tapebinder.
2. Identification Devices:
    a. Sleeve-type, permanent, PVC, yellow or white, with legible machine-printed black markings.
    b. Manufacturer and Products: Raychem; Type D-SCE or ZH-SCE.
3. Connectors and Terminations:
    a. Nylon, Self-Insulated Crimp Connectors:
        1) Manufacturers and Products:
            a) Thomas & Betts; Sta-Kon.
            b) Burndy; Insulug.
            c) ILSCO.
4. Self-Insulated, Freespring Wire Connector (Wire Nuts):
    a. Plated steel, square wire springs.
    b. UL Standard 486C.
    c. Manufacturers and Products:
        1) Thomas & Betts.
        2) Ideal; Twister.

5. Cable Lugs:
    a. In accordance with NEMA CC 1.
    b. Rated 600 volts of same material as conductor metal.
    c. Uninsulated Crimp Connectors and Terminators:
        1) Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
        2) Manufacturers and Products:
            a) Thomas & Betts; Color-Keyed.
            b) Burndy; Hydent.
            c) ILSCO.
    d. Uninsulated, Bolted, Two-Way Connectors and Terminators:
        1) Manufacturers and Products:
            a) Thomas & Betts; Locktite.
            b) Burndy; Quiklug.
            c) ILSCO.
6. Cable Ties:
    a. Nylon, adjustable, self-locking, and reusable.
    b. Manufacturer and Product: Thomas & Betts; TY-RAP.
7. Heat Shrinkable Insulation:
    a. Thermally stabilized, crosslinked polyolefin.
    b. Manufacturer and Product: Thomas & Betts; SHRINK-KON.

2.23 MOTORS

A. Three-Phase:

1. For multiple units of the same type of equipment, furnish identical motors and accessories of a single manufacturer.
2. Meet requirements of NEMA MG 1.
3. Provide motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.
4. Motors shall be specifically designed for use and conditions intended, with a NEMA design letter classification to fit application.
5. Lifting lugs on motors weighing 100 pounds or more.
6. Operating Conditions: Maximum ambient temperature not greater than 40 degrees C.
7. Horsepower Rating: As required. Brake horsepower of the driven equipment at any operating condition shall not exceed motor nameplate horsepower rating, excluding any service factor.
8. Service Factor: 1.15 minimum at rated ambient temperature, unless otherwise shown.

9. Efficiency and Power Factor: Provide premium efficiency units, except for under 1 hp, multispeed, or short-time rated motors, or motors driving gates, valves, elevators, cranes, trolleys, and hoists. Provide standard power factor.
10. Insulation Systems: Unless otherwise indicated, Class B or Class F at nameplate horsepower and designated operating conditions, except EXP motors that shall be Class B with Class B rise.
11. Enclosures:
    a. TEFC and TENV: Furnish with a drain hole with porous drain/weather plug.
    b. Explosion-Proof (EXP):
        1) TEFC listed to meet UL 674 and NFPA 70 requirements for Class I, Division 1, Group D hazardous locations.
        2) Drain holes with drain and breather fittings.
        3) Integral thermostat opening on excessive motor temperature in accordance with UL 2111 and NFPA 70.
        4) Terminate thermostat leads in terminal box separate from main terminal box.
    c. Equipment Finish: Manufacturer's standard.
12. Nameplates: In accordance with NEMA MG1.
13. Inverter Duty Motor:
    a. Motor supplied power by adjustable frequency drives shall be inverter duty-rated.
    b. Motor shall meet all applicable requirements of NEMA MG 1, Section IV, Parts 30 and 31.
    c. Motor shall be suitable for operation over entire speed range indicated.
    d. Provide forced ventilation where speed ratio is greater than published range for motor being installed. Provide and coordinate fan power supply and motor control requirements with associated drive.
    e. Motor installed in Division 1 hazardous (classified) locations shall be identified as acceptable for variable speed when used in a Division 1 location.

B. Manufacturers:

1. General Electric.
2. Reliance Electric.
3. U.S. Electrical Motors.

C. Factory Testing:

1. Tests:
    a. In accordance with IEEE 112 for polyphase motors and IEEE 114 for single-phase motors.

b. Provide routine (production) tests on all motors in accordance with NEMA MG 1. Test multispeed motors at all speeds.
c. For premium efficiency motors, test efficiency and power factor at 50, 75, and 100 percent of rated horsepower:
1) In accordance with IEEE 112, Test Method B, and NEMA MG 1, Paragraphs 12.54 and 12.57.
2) Furnish a copy of a certified motor efficiency test report for identical motor.

2. Test Report Forms:
a. Routine Tests: IEEE 112, Form A-1.
b. Efficiency and power factor by Test Method B, IEEE 112, Form A-2, and NEMA MG 1, Paragraph (table) 12.57.

2.24 GROUNDING

A. Ground Rods: Provide copper-clad steel with minimum diameter of 5/8-inch, and length of 10 feet.

B. Ground Conductors: As specified in Article Conductors and Cable.

C. Connectors:

1. Exothermic Weld Type:
a. Outdoor Weld: Suitable for exposure to elements or direct burial.
b. Indoor Weld: Utilize low-smoke, low-emission process.
c. Manufacturers:
1) Erico Products, Inc.; Cadweld and Cadweld Exolon.
2) Thermoweld.

2. Compression Type:
a. Compress-deforming type; wrought copper extrusion material.
b. Single indentation for conductors 6 AWG and smaller.
c. Double indentation with extended barrel for conductors 4 AWG and larger.
d. Single barrels prefilled with oxide-inhibiting and antiseizing compound.
e. Manufacturers:
1) Burndy Corp.
2) Thomas and Betts Co.
3) ILSCO.

3. Mechanical Type:
a. Split-bolt, saddle, or cone screw type; copper alloy material.
b. Manufacturers:
1) Burndy Corp.
2) Thomas and Betts Co.

2.25 LOW VOLTAGE MOTOR CONTROL

A. General:

1. Make adjustments as necessary to wiring, conduit, disconnect devices, motor starters, branch circuit protection, and other affected material or equipment to accommodate motors and motor ratings actually provided.
2. Controllers: NEMA ICS 2, Class A.
3. Thermal Overload Protection:
    a. Inverse-time-limit characteristic.
    b. Heater: Bimetallic overload, adjustable trip.
    c. Relay Trip: Standard, Class 20.
    d. Manual reset.
    e. Provide in each ungrounded phase.
    f. Mount within starter unit.
4. Control Transformer:
    a. Two winding, 120-volt secondary, primary voltage to suit.
    b. Two current-limiting fuses for primary circuit.
    c. One fuse in secondary circuit.
    d. Mount within starter unit.
5. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
6. Phase Monitoring Relay: Provide three-phase monitoring relay to protect against low voltage, voltage unbalance, phase loss, and phase reversal.

B. Combination Full-Voltage, Magnetic Starter:

1. Rating: Horsepower rated at 600 volts, UL labeled for 22,000 amperes with overload protection.
2. Three-phase, nonreversing, full voltage.
3. Control: As required.
4. Disconnect Type: Circuit breaker.
5. Enclosure: NEMA 250, Type 4X.
6. Padlockable operating handle.

C. Manufacturers:

1. Eaton.
2. General Electric.
3. Square D.
4. Allen-Bradley.

PART 3 EXECUTION

3.01 GENERAL

A. Install materials and equipment in accordance with manufacturer’s instructions and recommendations.

B. Work shall comply with all applicable provisions of NECA 1.

C. Install materials and equipment in hazardous areas in a manner acceptable to regulatory authority having jurisdiction for the class, division, and group of hazardous areas shown.

D. Electrical Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.

3.02 DEMOLITION

A. General Demolition:
   1. Where shown, de-energize and disconnect nonelectrical equipment for removal by others.
   2. Where shown, de-energize, disconnect, and remove electrical equipment.
   3. Remove affected circuits and raceways back to serving panelboard or control panel. Where affected circuits are consolidated with others, remove raceways back to first shared condulet or box. Where underground or embedded raceways are to be abandoned, remove raceway to 1 inch below surface of structure or 12 inches belowgrade and restore existing surface.

3.03 PROTECTION FOLLOWING INSTALLATION

A. Protect materials and equipment from corrosion, physical damage, and effects of moisture on insulation.

B. Cap conduit runs during construction with manufactured seals.

C. Close openings in boxes or equipment during construction.

D. Energize space heaters furnished with equipment.

3.04 SERVICE ENTRANCE EQUIPMENT AND METERING

A. Unless otherwise specified or shown, schedule and coordinate work of serving utility as required to provide electric service to the Work.

3.05 OUTLET AND DEVICE BOXES

A. Install suitable for conditions encountered at each outlet or device in wiring or raceway system, sized to meet NFPA 70 requirements.

B. Size:

   1. Depth: Minimum 2 inches, unless otherwise required by structural conditions. Box extensions not permitted.
      a. Hollow Masonry Construction: Install with sufficient depth such that conduit knockouts or hubs are in masonry void space.

2. Ceiling Outlet: Minimum 4-inch octagonal sheet steel device box, unless otherwise required for installed fixture.
3. Switch and Receptacle: Minimum 2-inch by 4-inch sheet steel device box.

C. Install plumb and level.

D. Flush Mounted:

1. Install with concealed conduit.
2. Install proper type extension rings or plaster covers to make edges of boxes flush with finished surface.

E. Support boxes independently of conduit by attachment to building structure or structural member.

F. Box Type (Steel Raceway System):

1. Outdoor Locations: Cast metal.
2. Indoor Dry Locations:
   a. Exposed Rigid Conduit: Cast metal.
   b. Concealed Raceways: Sheet steel.
   c. Class I, II, or III Hazardous Areas: Cast metal.
3. Indoor Wet Locations:
   a. Exposed Raceways: Cast metal.
   b. Concealed Raceways: Cast metal.
   c. Class I, II, or III Hazardous Areas: Cast metal.
4. Cast-in-Place Concrete Slabs: Sheet steel.

G. Box Type, Corrosive Locations (PVC-Coated rigid Galvanized Steel Raceway System): PVC-coated cast metal with matching cover.

3.06 JUNCTION AND PULL BOXES

A. Install where shown and where necessary to terminate, tap-off, or redirect multiple conduit runs.

B. Install pull boxes where necessary in raceway system to facilitate conductor installation.

C. Install in conduit runs at least every 150 feet or after the equivalent of three right-angle bends.

D. Use outlet boxes as junction and pull boxes wherever possible and allowed by applicable codes.

E. Use conduit bodies as junction and pull boxes where no splices are required and their use is allowed by applicable codes.

F. Installed boxes shall be accessible.

G. Do not install on finished surfaces.

H. Install plumb and level.

I. Support boxes independently of conduit by attachment to building structure or structural member.

J. At or Belowgrade:

1. Install boxes for belowgrade conduit flush with finished grade in locations outside of paved areas, roadways, or walkways.
2. If adjacent structure is available, box may be mounted on structure surface just above finished grade in accessible but unobtrusive location.
3. Use boxes and covers suitable to support anticipated weights.

K. Flush Mounted:

1. Install with concealed conduit.
2. Holes in surrounding surface shall be no larger than required to receive box.
3. Make edges of boxes flush with final surface.

L. Mounting Hardware:

1. Noncorrosive Indoor Dry Areas: Galvanized.
2. Outdoor or Noncorrosive Indoor Wet Areas: Stainless steel.
3. Corrosive Areas: Stainless steel.

M. Location/Type:

1. Indoor and Outdoor, Wet or Corrosive: NEMA 250, Type 4X, stainless steel.
2. Indoor and Outdoor, Hazardous: NEMA 250 Type 7 as required for area.
3. Underground Conduit: Concrete.
4. Corrosive: NEMA 250, Type 4X, stainless steel.
5. Outdoor, Where Indicated Weatherproof (WP): NEMA 250, Type 3R.

3.07 WIRING DEVICES

A. Switches:

1. Install with switch operation in vertical position.
2. Install single-pole, two-way switches such that toggle is in up position when switch is on.

B. Receptacles:

1. Weatherproof Receptacles:
    a. Install in cast metal box.
    b. Install such that hinge for protective cover is above receptacle opening.
2. Ground Fault Interrupter: Install feed-through model at locations where ground fault protection is specified for “downstream” conventional receptacles.

3.08 DEVICE PLATES

A. Securely fasten to wiring device; ensure a tight fit to box.

B. Flush Mounted: Install with all four edges in continuous contact with finished wall surfaces without use of mats or similar materials. Plaster fillings will not be acceptable.

C. Surface Mounted: Plate shall not extend beyond sides of box, unless plates have no sharp corners or edges.

D. Install with alignment tolerance to box of 1/16 inch.

E. Types (Unless Otherwise Shown):

1. Outdoor: Weatherproof.
2. Indoor:
    a. Flush Mounted Boxes: Metal.
    b. Surface Mounted, Metal Boxes: Cast.

3.09 PANELBOARDS AND MINI-POWER CENTERS

A. Install securely, plumb, in-line and square with walls.

B. Install top of cabinet 6 feet above floor, unless otherwise shown.

C. Provide typewritten circuit directory for each panelboard.

D. Cabinet Location/Type:

1. Wet or Outdoor: NEMA 250, Type 3R, Outdoor.

3.10 CIRCUIT BREAKERS AND SWITCHES

A. Location and Enclosure Type:

1. Hazardous Gas: NEMA 250, Type 7.
2. Wet or Outdoor or Corrosive: NEMA 250, Type 4X.
3. Where Denoted WP: NEMA 250, Type 3R.

3.11 TERMINAL BLOCKS

A. Install for termination of control circuits entering or leaving equipment and local control panels.

3.12 DRY TYPE POWER TRANSFORMERS (0- TO 600-VOLT PRIMARY)

A. Load external vibration isolator such that no direct transformer unit metal is in direct contact with mounting surface.

B. Provide moisture-proof flexible conduit for electrical connections.

C. Connect voltage taps to achieve (approximately) rated output voltage under normal plant load conditions.

D. Provide wall brackets where required.

3.13 SUPPORT AND FRAMING CHANNELS

A. Install where required for mounting and supporting electrical equipment and raceway systems.

3.14 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) EQUIPMENT

A. Install in accordance with manufacturer's instructions, including lead length, overcurrent protection, and grounding.

3.15 CONDUIT AND FITTINGS

A. General:

1. Crushed or deformed raceways not permitted.
2. Maintain raceway entirely free of obstructions and moisture.
3. Immediately after installation, plug or cap raceway ends with watertight and dust-tight seals until time for pulling in conductors.
4. Sealing Fittings: Provide drain seal in vertical raceways where condensate may collect above sealing fitting.
5. Avoid moisture traps where possible. When unavoidable in exposed conduit runs, provide junction box and drain fitting at conduit low point.
6. Group raceways installed in same area.
7. Follow structural surface contours when installing exposed raceways. Avoid obstruction of passageways.
8. Run exposed raceways parallel or perpendicular to walls, structural members, or intersections of vertical planes.
9. Block Walls: Do not install raceways in same horizontal course with reinforcing steel.
10. Install watertight fittings in outdoor, underground, or wet locations.

11. Paint threads and cut ends, before assembly of fittings, galvanized conduit, or PVC-coated galvanized conduit installed in exposed or damp locations with zinc-rich paint or liquid galvanizing compound.
12. Metal conduit to be reamed, burrs removed, and cleaned before installation of conductors, wires, or cables.
13. Do not install raceways in concrete equipment pads, foundations, or beams.
14. Horizontal raceways installed under floor slabs shall lie completely under slab, with no part embedded within slab.
15. Install concealed, embedded, and buried raceways so that they emerge at right angles to surface and have no curved portion exposed.
16. Install conduits for fiber optic cables, telephone cables, and Category 5 data cables in strict conformance with the requirements of EIA/TIA 569.

B. Conduit Application:

1. Diameter Minimum: 3/4 inch.
2. Outdoor, Exposed: PVC-coated rigid galvanized steel.
3. Indoor, Exposed: Aluminum.
4. Direct Earth Burial: PVC-coated rigid galvanized steel.
5. Under Slabs-On-Grade: PVC-coated rigid galvanized steel.
6. Corrosive Areas: Aluminum.
7. Classified Areas: Aluminum.

C. Connections:

1. For motors-, wall-, or ceiling-mounted fans and unit heaters, dry type transformers, electrically operated valves, instrumentation, and other equipment where flexible connection is required to minimize vibration:
   a. General: Flexible metal, liquid-tight conduit.
   b. Hazardous Areas: Flexible coupling suitable for Class I, Division 1 and 2 areas.
   c. Wet or Corrosive Areas: Flexible metal liquid-tight.
   d. Length: 18 inches minimum, 60 inches maximum, sufficient to allow movement or adjustment of equipment.
2. Outdoor areas, process areas exposed to moisture, and areas required to be oiltight and dust-tight: Flexible metal, liquid-tight conduit.

D. Penetrations:

1. Make at right angles, unless otherwise shown.
2. Notching or penetration of structural members, including footings and beams, not permitted.

E. Support:

1. Support from structural members only, at intervals not exceeding NFPA 70 requirements, and in any case not exceeding 10 feet. Do not support from piping, pipe supports, or other raceways.
2. Application/Type of Conduit Strap:
    a. Steel Conduit: Zinc-coated steel, pregalvanized steel, or malleable iron.
    b. PVC-Coated Rigid Steel Conduit: PVC-coated metal.

F. Bends:

1. Install concealed raceways with a minimum of bends in the shortest practical distance.
2. Make bends and offsets of longest practical radius. Bends in conduits and ducts being installed for fiber optic cables shall be not less than 20 times cable diameter, 15 inches minimum.
3. Install with symmetrical bends or cast metal fittings.
4. Avoid field-made bends and offsets, but where necessary, make with acceptable hickey or bending machine. Do not heat metal raceways to facilitate bending.
5. Make bends in parallel or banked runs from same center or centerline with same radius so that bends are parallel.
6. Factory elbows may be installed in parallel or banked raceways if there is change in plane of run and raceways are same size.
7. Flexible Conduit: Do not make bends that exceed allowable conductor bending radius of cable to be installed or that significantly restricts conduit flexibility.

G. Expansion and Deflection Fittings: Provide on all raceways at structural expansion joints and in long tangential runs.

H. PVC-Coated Rigid Steel Conduit:

1. Install in accordance with manufacturer's instructions.
2. All tools and equipment used in the cutting, bending, threading, and installation of PVC-coated rigid steel conduit shall be designed to limit damage to the PVC coating.
3. Provide PVC boot to cover all exposed threading.

I. Termination at Enclosures:

1. Cast Metal Enclosure: Provide manufacturer's premolded insulating sleeve inside metallic conduit terminating in threaded hubs.
2. Nonmetallic, Cabinets, and Enclosures: Terminate conduit in threaded conduit hubs, maintaining enclosure integrity.
3. Sheet Metal Boxes, Cabinets, and Enclosures:
    a. Rigid Galvanized Conduit:
        1) Provide one lock nut each on inside and outside of enclosure.

2) Install grounding bushing.
3) Provide bonding jumper from grounding bushing to equipment ground bus or ground pad; if neither ground bus nor pad exists, connect jumper to lag bolt attached to metal enclosure.
4) Install insulated bushing on ends of conduit where grounding is not required.
5) Provide insulated throat when conduit terminates in sheet metal boxes having threaded hubs.
6) Utilize sealing locknuts or threaded hubs on outside of NEMA 3R and NEMA 12 enclosures.
7) Terminate conduits with threaded conduit hubs at NEMA 4 and 4X boxes and enclosures.

b. Flexible Metal Conduit: Provide two-screw type, insulated, malleable iron connectors.
c. PVC-Coated Rigid Galvanized Steel Conduit: Provide PVC-coated, liquid-tight, metallic connector.

4. Free-Standing Enclosures: Terminate metal conduit entering bottom with grounding bushing; provide a grounding jumper extending to equipment ground bus or grounding pad.

J. Underground Raceways:

1. Grade: Maintain minimum grade of 4 inches in 100 feet, either from one manhole, handhole, or pull box to the next, or from a high point between them, depending on surface contour.
2. Cover: Maintain minimum 2-foot cover above conduit, unless otherwise shown.
3. Make routing changes as necessary to avoid obstructions or conflicts.
4. Couplings: In multiple conduit runs, stagger so couplings in adjacent runs are not in same transverse line.
5. Union type fittings not permitted.
6. Spacers:
   a. Provide preformed, nonmetallic spacers, designed for such purpose, to secure and separate parallel conduit runs in a trench.
   b. Install at intervals not greater than that specified in NFPA 70 for support of the type conduit used, but in no case greater than 10 feet.
7. Support conduit so as to prevent bending or displacement during backfilling.
8. Installation with Other Piping Systems:
   a. Crossings: Maintain minimum 12-inch vertical separation.
   b. Parallel Runs: Maintain minimum 12-inch separation.
   c. Installation over valves or couplings not permitted.
9. Metallic Raceway Coating: Along entire length, coat with raceway coating.

K. Empty Raceways:

1. Provide permanent, removable cap over each end.
2. Provide nylon pull cord.
3. Identify, as specified in Article Identification Devices, with waterproof tags attached to pull cord at each end, and at intermediate pull point.

L. Identification Devices:

1. Warning Tape: Install approximately 12 inches above underground or concrete-encased raceways. Align parallel to, and within 12 inches of, centerline of runs.

M. Raceway Band:

1. Install wherever metallic conduit emerges from concrete slabs. Not required with PVC-coated RGS conduit. Center band at slab surface and install according to manufacturer's instructions.
   a. Slip-on Type: Clean conduit surface at installation location. Cut tubing to 4-inch minimum lengths and slip onto raceway prior to slab placement and termination of conduit. Heat-shrink onto conduit.
   b. Wrap-around Type: Use where slip-on access to conduit is not possible. Clean conduit surface at installation location. Apply primer. Apply wraps to provide two layers of tape. Neatly finish tape end to prevent unraveling.

3.16 CONDUCTORS AND CABLES

A. Conductor storage, handling, and installation shall be in accordance with manufacturer's recommendations.

B. Do not exceed manufacturer's recommendations for maximum pulling tensions and minimum bending radii.

C. Conduit system shall be complete prior to drawing conductors. Lubricate prior to pulling into conduit. Lubrication type shall be as approved by conductor manufacturer.

D. Terminate all conductors and cables, unless otherwise shown.

E. Do not splice conductors, unless specifically indicated or approved by Engineer.

F. Wiring within Equipment and Local Control Panels: Remove surplus wire, dress, bundle, and secure.

G. Power Conductor Color Coding:

1. No. 6 AWG and Larger: Apply general purpose, flame retardant tape at each end, and at accessible locations wrapped at least six full overlapping turns, covering an area 1-1/2 to 2 inches wide.
2. No. 8 AWG and Smaller: Provide colored conductors.
3. Colors:
    a. Neutral Wire: White.
    b. Live Wires, 120/240-Volt, Single-Phase System: Black, red.
    c. Live Wires, 120/208-Volt, Three-Phase System: Black, red, or blue.
    d. Live Wires, 277/480-Volt, Three-Phase System: Brown, orange, or yellow.
    e. Ground Wire: Green.

H. Circuit Identification:

1. Assign circuit name based on device or equipment at load end of circuit. Where this would result in same name being assigned to more than one circuit, add number or letter to each otherwise identical circuit name to make it unique.
2. Method: Identify with sleeves. Taped-on markers or tags relying on adhesives not permitted.

I. Connections and Terminations:

1. Install wire nuts only on solid conductors.
2. Install nylon self-insulated crimp connectors and terminators for instrumentation and control circuit conductors.
3. Tape insulate all uninsulated connections.
4. Install crimp connectors and compression lugs with tools approved by connector manufacturer.

3.17 GROUNDING

A. Grounding shall be in compliance with NFPA 70 and as shown.

B. Ground electrical service neutral at service entrance equipment to supplementary grounding electrodes.

C. Ground each separately derived system neutral to nearest effectively grounded building structural steel member or separate grounding electrode.

D. Bond together system neutrals, service equipment enclosures, exposed noncurrent-carrying metal parts of electrical equipment, metal raceways, ground conductor in raceways and cables, receptacle ground connections, and metal piping systems.

E. Shielded Instrumentation Cables:

1. Ground shield to ground bus at power supply for analog signal.
2. Expose shield minimum 1 inch at termination to field instrument and apply heat shrink tube.
3. Do not ground instrumentation cable shield at more than one point.

F. Equipment Grounding Conductors: Provide in all conduits containing power conductors and control circuits above 50 volts.

G. Ground Rods: Install full length with conductor connection at upper end. Install one ground rod in each handhole.

3.18 LOW VOLTAGE MOTOR CONTROL

A. Install equipment in accordance with NEMA ICS 2.3 and manufacturer's instructions and recommendations.

B. Field adjust trip settings of motor starter magnetic-trip-only circuit breakers. Adjust to approximately 11-times motor rated current.

C. Select and install overload relay heaters or adjust electronic overload protection after the actual nameplate full-load current rating of motor has been determined.

3.19 FIELD QUALITY CONTROL

A. General:

1. Test equipment shall have an operating accuracy equal to, or greater than, requirements established by NETA ATS.
2. Test instrument calibration shall be in accordance with NETA ATS.
3. Perform inspection and electrical tests after equipment has been installed.
4. Perform tests with apparatus de-energized whenever feasible.
5. Inspection and electrical tests on energized equipment are to be:
   a. Scheduled with ESD prior to de-energization.
   b. Minimized to avoid extended period of interruption to the operating plant equipment.

B. Tests and inspection shall establish that:

1. Electrical equipment is operational within industry and manufacturer's tolerances.
2. Installation operates properly.
3. Equipment is suitable for energization.
4. Installation conforms to requirements of Contract Documents and NFPA 70.

C. Perform inspection and testing in accordance with NETA ATS, industry standards, and manufacturer's recommendations.

D. Adjust mechanisms and moving parts for free mechanical movement.

E. Adjust adjustable relays and sensors to correspond to operating conditions, or as recommended by manufacturer.

F. Verify nameplate data for conformance to Contract Documents.

G. Realign equipment not properly aligned and correct unlevelness.

H. Properly anchor electrical equipment found to be inadequately anchored.

I. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench to manufacturer's recommendations, or as otherwise specified.

J. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.

K. Provide proper lubrication of applicable moving parts.

L. Investigate and repair or replace:

1. Electrical items that fail tests.
2. Active components not operating in accordance with manufacturer's instructions.
3. Damaged electrical equipment.

M. Electrical Enclosures:

1. Remove foreign material and moisture from enclosure interior.
2. Vacuum and wipe clean enclosure interior.
3. Remove corrosion found on metal surfaces.
4. Repair or replace, as determined by Engineer, door and panel sections having damaged surfaces.
5. Replace missing or damaged hardware.

N. Provide certified test report(s) documenting the successful completion of specified testing. Include field test measurement data.

O. Test the following equipment and materials:

1. Conductors: Insulation resistance, No. 4 and larger only.
2. Panelboards, switches, and circuit breakers.
3. Motor controls.
4. Grounding electrodes.
5. Motors.

P. Controls:

1. Test control and signal wiring for proper termination and function.
2. Test local control panels and other control devices for proper terminations, configuration and settings, and functions.
3. Demonstrate control, monitoring, and indication functions in presence of Owner and Engineer.

Q. Balance electrical load between phases on panelboards and mini-power centers after installation.

R. Voltage Testing:

1. When installation is complete and facility is in operation, check voltage at point of termination of electric utility supply system to Project.
2. Check voltage amplitude and balance between phases for loaded and unloaded conditions.
3. If unbalance exceeds 1 percent, or if voltage varies throughout the day and from loaded to unloaded conditions more than plus or minus 4 percent of nominal, make written request to electric utility to correct condition.
4. If corrections are not made, obtain written statement from a responsible electric utility official that voltage variations and/or unbalance are within their normal standards.

S. Equipment Line Current:

1. Check line current in each phase for each piece of equipment.
2. If electric utility makes adjustments to supply voltage magnitude or balance, make line current check after adjustments are made.

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SECTION 26 32 14
NATURAL GAS ENGINE GENERATOR SET

PART 1 GENERAL

1.01 SCOPE

A. Provide complete factory assembled generator set equipment with digital (microprocessor-based) electronic controls.

B. Provide factory test, startup by a supplier authorized by the manufacturer, and onsite testing of the system.

C. The generator set manufacturer shall warrant all equipment provided under this section so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM): A335/A335M, Specification for Seamless Ferritic Alloy-Steel Pipe for High-Temperature Service.
2. Code of Federal Regulations (CRF): Title 40 Volume 18, Control of Emissions from New and In-Use Non-road Compression-Ignition Engines.
3. National Electric Manufacturer's Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
   b. MG 1, Motors and Generators.
4. National Electrical Contractors Association (NECA): 404, Recommended Practice for Installing Generator Sets.
5. National Fire Protection Association (NFPA):
   a. 37, Installation and Use of Stationary Combustion Engines and Gas Turbines.
   b. 70, National Electric Code.
   c. 110, Emergency and Standby Power Systems.
6. SAE International (SAE): J1074, Engine Sound Level Measurement.
7. Underwriters Laboratories, Inc. (UL):
   a. 142, Steel Aboveground Tanks for Flammable and Combustible Liquids.
   b. 508, Industrial Control Equipment.

c. 1236, Battery Chargers for Charging Engine-Starter Batteries.
d. 2085, Protected Aboveground Tanks for Flammable and Combustible Liquids.
e. 2200, Stationary Engine Generator.

1.03 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.

B. Manufacturer Special Requirements:

1. Generator set shall be listed to UL 2200 or submitted to an independent third party certification process to verify compliance as installed.
2. Manufacturer of generator set shall be certified to ISO 9001 and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.04 AIR QUALITY PERMIT

A. Obtain prior to releasing generator for production.

1.05 WARRANTY

A. Provide manufacturer’s guarantee or warranty with no deductibles and including travel time, service hours, repair parts and expendables (oil, filters, antifreeze and other items required for the complete repair) with the ESD named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction of the Work specified in this Specification section found defective during a period of 2 years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in the General Conditions.

1.06 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following spare parts and special tools:

Item	Quantity
Lubricating oil filter elements with gasket	3 complete sets
Air cleaner filter element	1 complete set
Cooling fan drive belt (if applicable)	2 complete sets
Hydrometer	1 each
Two-pronged battery voltmeter	1 each
Spare fuses, if used in control panel	1 complete set
Spare indicating lamps (if applicable)	4 each type used
Touch up paint	1 quart each color used
Special tools required to maintain or dismantle engine generator set	1 complete set

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials and equipment specified in this section shall be products of:

1. Cummins.
2. Caterpillar.
3. Kohler Power Series.

2.02 GENERAL

A. Ratings: Standby service.

B. Vibration Design:

1. Use vibration analytical techniques to determine shaft critical speeds, and to develop bearing design and shaft balancing to mitigate vibration.
2. Apply torsional analysis and design to mitigate torsional vibration.
3. Engine and generator, individually, shall not exhibit vibration in any plane exceeding 10 mils at continuous rating point, when measured at attachment points to common steel subbase.

2.03 ENGINE

A. General:

1. Manufacturer's standard design, unless otherwise specified.
2. Engine parts designed with adequate strength for specified duty.

B. Type: Natural gas fueled, with unit mounted radiator and fan cooling.

C. Starting System:

1. Type: Automatic, using 12-volt or 24-volt battery-driven starter acting in response to control panel.
2. Starter shall be capable of three complete cranking cycles without overheating.
3. Batteries:
   a. Sized as recommended by engine manufacturer.
   b. Lead-acid type.
   c. Capable of providing 15 seconds minimum of cranking current at 0 degree C and three complete 15-second cranking cycles at 40 degrees C.
   d. Housed in acid-resistant frame isolated from engine generator main frame.
   e. Located such that maintenance and inspection of engine is not hindered.
   f. Complete with battery cables and connectors.
4. Battery Charger:
   a. Manufacturer and Part: Newmar PT-7
   b. UL 1236 listed and labeled.
   c. 10-amp automatic float, taper and equalize charge type, with plus or minus 1 percent voltage regulation over a plus or minus 10 percent input voltage variation.
   d. Temperature compensated to operate over an ambient range of minus 30 degrees C to 50 degrees C.
   e. Locate charger in automatic transfer switch, generator control panel, or wall mounted in generator enclosure. Generator manufacturer shall coordinate location.
   f. Include:
      1) Ammeter and voltmeter.
      2) Fused ac input and dc output.
      3) Power ON pilot light.
      4) AC failure relay and light.
      5) Low and high dc voltage alarm relay and light.
   g. Alarm relay dry contacts rated 4 amps at 120V ac.

D. Governing System:

1. Electro-mechanical or electro-hydraulic type.
2. Regulates speed as required to hold generating frequency within tolerable limits and within 5 percent of nominal design speed.
3. Accessories:
    a. Manual speed control device.
    b. Positive overspeed trip switch.

E. Jacket Water Cooling System:

1. Radiator:
    a. Consisting of jacket water pump, fan assembly, fan guard, and duct flange outlet.
    b. Cooling System: Rated for full load operation.
    c. Fan: Suitable for use in a system with 0.5 in H_2O restriction.
    d. Sized based on a core temperature that is 20 degrees F higher than rated operation temperature.
2. Engine Thermostat: As recommended by manufacturer to regulate engine water temperature.
3. Jacket Water Heater:
    a. Maintain engine water temperature at 120 degrees F with an ambient temperature of 50 degrees F.
    b. Thermostatically controlled.
4. Engine Cooling Liquid: Fill cooling system with a 50/50-ethylene glycol/water mixture prior to shipping.

F. Lubrication System:

1. Type: Full-pressure.
2. Accessories:
    a. Pressure switch to initiate shutdown on low oil pressure.
    b. Oil filter with replaceable element.
    c. Bayonet type oil level stick.
    d. Valved oil drain extension.
3. Oil Cooling System: Water-cooled heat exchanger utilizing jacket water.

G. Exhaust System:

1. Muffler: Rated for critical silencing.
2. Exhaust Pipe: ASTM A335, Grade P11, standard wall, with fittings selected to match piping materials.
3. Pipe Connections: Welded.

4. Engine Connection:
    a. Flanged, flexible, corrugated, Type 321 stainless steel expansion fitting.
    b. Length as required for flexibility and expansion in piping arrangement shown on Drawings.

H. Air Intake System: Equip with dry type air cleaner with filter service (restriction) indicator.

2.04 GENERATOR

A. General:

1. Meet requirements of NEMA MG 1.
2. Synchronous type with 2/3 pitch, revolving field, drip-proof construction, air cooled by a direct drive centrifugal blower fan.
3. Stator Windings:
    a. Skewed for smooth voltage waveform.
    b. Reconnectable, 12 lead.
4. Overspeed Capability: 125 percent.
5. Waveform Deviation from Sine Wave: 5 percent maximum.
6. Telephone Interference Factor: 50 maximum.
7. Total Harmonic Current and Voltage Distortion: 5 percent maximum, measured at generator main circuit breaker.

B. Insulation System:

1. Class H, with a maximum rise of 125 degrees C over 40 degree C ambient in accordance with NEMA MG 1.
2. Epoxy varnish.

C. Excitation System:

1. Field brushless type or permanent magnet generator (PMG) exciter.
2. PMG and Controls: Capable of providing regulated current, at a rate of 300 percent of nameplate current, to a single-phase or three-phase fault for 10 seconds.

D. Voltage Regulation:

1. Solid state, three-phase sensing type.
2. Adjustable output voltage level to plus or minus 5 percent.
3. Provisions for proper voltage regulation for existing or future adjustable frequency drives as part of generator load.

E. Voltage and Frequency Regulation Performance:

1. Steady State Voltage Regulation: Less than plus or minus 1 percent from no load to continuous rating point.
2. NEMA MG 1 Defined Transient Voltage Dip:
   a. Less than 20 percent at rapid application of rated load.
   b. Recovery to rated voltage and frequency within 2 seconds following initial load application.
3. Steady State Frequency Regulation: Plus or minus 1.5-Hz overload range.

F. Motor Starting Capability: Shall be sized to handle all pumps starting in a single step.

G. Short Circuit Capabilities: Sustain 300 percent of rated current for 10 seconds for external three-phase bolted fault without exceeding rated temperatures.

H. Main Circuit Breaker:

1. Type: Molded case.
2. Current Rating: As recommended by generator manufacturer.
3. Interrupt Rating: Suitable for amperes and voltage to match power service.
4. Enclosure: Mounted with vibration isolation from engine generator set.
5. Surge Protective Devices: Three-phase capacitors and arresters mounted in terminal compartment.

2.05 BASEPLATE

A. Mount engine generator set on a rigid common steel base frame.

B. Base frame shall be stiffened to minimize deflections.

2.06 VIBRATION ISOLATORS

A. Provide vibration isolators, spring/pad type.

B. Include seismic restraints if required by Site location.

2.07 AUTOMATIC LOAD TRANSFER CONTROL

A. General:

1. Automatic run controls shall be suitable for interface and control by automatic transfer switch. Engine generator set shall start and run upon closure of a remote dry contact provided by the Automatic Transfer Switch.
2. In accordance with applicable standards of NFPA 70, NEMA ICS 1, NEMA ICS 2, NEMA ICS 6, IEEE C37.90.1, and UL 1008.

3. Transfer switch consisting of inherently double-throw power switch unit with interconnected control module.
4. Rated 100 percent, in amperes, for total system transfer of motor, electric heating, discharge lamp loads, and tungsten-filament lamp loads.

B. Enclosure: Nonventilated NEMA 250, Type 4 with enclosure grounding terminal. Dead front, front accessible cabinet with 14-gauge welded steel construction. Continuously hinged single door, with handle and lock cylinder.

C. Transfer Switch: Electrically operated, mechanically held, double-throw. Momentarily energized, single-electrically operated mechanism energized from source to which load is to be transferred. Mechanical interlock switch to ensure only one of two possible switch positions. Manual operating handle for transfer in either direction under either loaded or unloaded conditions.

D. Control Module:

1. Microprocessor for sensing and logic control with inherent digital communications capability.
2. Connected to transfer switch by wiring harness having keyed disconnect plug.
3. Adjustable solid state undervoltage sensors for all three phases of normal and for one phase of standby source. Pick up at 85 to 100 percent nominal. Dropout 75 to 98 percent pickup setting.
4. Adjustable frequency sensors for standby source. Pickup 90 to 100 percent nominal. Dropout 87 to 98 percent of pickup setting.
5. Control module with adjustable time delays:
   a. 0.5 to 6 second engine start delay.
   b. 0 to 5 minute load transfer to emergency delay.
   c. 0 to 30 minute retransfer to normal delay.
   d. 0 to 30 minute unload running time delay.
   e. Switch to bypass any of the above time delays during testing.
6. Form-C start contacts, rated 10 amperes, 32-volt dc, for two-wire engine control, wired to terminal block.
7. Adjustable 0 to 5 minutes time delay relay for engine starting signal.

2.08 CONTROL SYSTEM

A. Control Panel:

1. Rating: NEMA 250, Type 12.
2. Material: Steel.
3. Instrument Identification: Face label or engraved, black, laminated plastic nameplate with white 1/4-inch high letters, attached with Type 422 stainless steel screws.

4. UL 508 listed.
5. Tested to meet or exceed IEEE 587 requirements for voltage surge resistance.

B. Instrumentation:

1. Type: Suitable for engine-mounted vibration environment.
2. Mounting: Nonshock mounted.
3. Alarm and Signal Contacts: Rated 5 amps at 120V ac, dry.
4. Fault Indication Lamps: Manufacturer's standard.
5. Meters: Digital with analog display or Analog, 3.5 inches, 240-degree scale, plus or minus 2 percent accuracy.

C. Operator Controls and Indicators:

1. HANDCRANK/STOP/AUTO/ENGINE TEST selector switch.
2. Generator voltage adjustment.
3. Voltmeter PHASE SELECTOR switch.
4. Ammeter PHASE SELECTOR switch.
5. Voltmeter.
6. Ammeter.
7. FREQUENCY meter.
8. Engine OIL PRESSURE indicator.
9. Engine jacket WATER TEMPERATURE indicator.
10. Engine SPEED indicator (RPM).
11. Engine OIL TEMPERATURE indicator.
12. RUNNING TIME indicator.
13. DC battery voltage.
14. Emergency Stop button.

D. Alarm Indicators with Manual Pushbutton RESET:

1. Low oil pressure.
2. High jacket water temperature.
3. Engine overspeed.
4. Engine overcrank.
5. Low/high dc voltage.

E. External Interfaces:

1. Furnish a single, common DPDT relay output upon occurrence of alarm condition.
2. Output: Dry contact rated 5 amps at 120V ac.
3. Accept remote dry start contact closure from automatic transfer switch, rated 10 amps at 32V dc.

F. Functional Requirements:

1. Recranking Lockout: When engine fires, starting control shall automatically disconnect cranking control to prevent recranking for a preset period of time after engine stop.
2. Overcranking Lockout: Initiate after four cranking cycles of 10 seconds on and 10 seconds off or provide continuous cranking cycle with crank time limiter.
3. Cooldown timer, adjustable from 5 minutes to 60 minutes.
4. Alarms:
   a. Low coolant level.
   b. Low battery voltage
   c. High battery voltage.
   d. Battery charger failure.
5. Engine shutdown upon any of the following conditions:
   a. Engine overspeed.
   b. Emergency stop button depressed.
   c. High jacket water temperature alarm setpoint and shutdown setpoint.
   d. Low oil pressure alarm setpoint and shutdown setpoint.
6. Air Inlet Damper Opening:
   a. Upon engine start sequence initiation, a normally closed, dry contact, rated 5 amps at 120V ac, from engine start circuit shall open to provide a signal to open air inlet dampers.
   b. Air inlet dampers shall fail open.

G. Special Requirements: Mount battery charger in control panel.

H. Power Requirements: Manufacturers stands internally connected.

2.09 OUTDOOR WEATHER-PROTECTIVE ENCLOSURE

A. General:

1. Provide generator set with outdoor enclosure, with entire package listed under UL 2200.
2. Package shall comply with requirements of NEC for wiring materials and component spacing.
3. Design total assembly of generator set and enclosure to be lifted into place using spreader bars.
4. Housing:
   a. Provide ample airflow for generator set operation at rated load in ambient temperature of 100 degrees F.
   b. Doors:
      1) Hinged access doors as required to maintain easy access for operating and service functions.

2) Lockable and include retainers to hold door open during service.

5. Roof: Cambered to prevent rainwater accumulation.
6. Openings: Screened to limit access of rodents into enclosure.
7. Electrical power and control interconnections shall be made within perimeter of enclosure.
8. Finishes:
   a. Prime sheet metal for corrosion protection and finish painted with manufacturer's standard color using a two-step electrocoating paint process, or equal meeting performance requirements specified below.
   b. Prime and paint surfaces of metal parts. Painting process shall result in coating that meets the following requirements:
      1) Primer: 0.5 mil to 2.0 mils thick.
      2) Top Coat: 0.8 mil to 1.2 mils thick.
      3) Gloss:
         a) Per ASTM D523, 80 percent plus or minus 5 percent.
         b) Gloss retention after 1 year shall exceed 50 percent.
      4) Crosshatch Adhesion: Per ASTM D3359, 4B-5B.
      5) Impact Resistance: Per ASTM D2794, 120-inch to 160-inch pounds.
      6) Salt Spray: Per ASTM B117, plus 1,000 hours.
      7) Humidity: Per ASTM D2247, plus 1,000 hours.
      8) Water Soak: Per ASTM D2247, plus 1,000 hours.
   c. Painting of hoses, clamps, wiring harnesses, and other nonmetallic service parts shall not be acceptable.
   d. Fasteners used shall be corrosion-resistant and designed to minimize marring of painted surface when removed for normal installation or service work.
9. Enclosure shall be constructed of minimum 12-gauge steel for framework and 14-gauge steel for panels.
10. Hardware and hinges shall be austenitic stainless steel.
11. Exhaust Silencer:
    a. Install factory-mounted exhaust silencer inside enclosure.
    b. Exhaust shall exit enclosure through a rain collar and terminate with a rain cap.
    c. Exhaust connections to generator set shall be through seamless flexible connections.
12. Maintenance Provisions:
    a. Flexible coolant and lubricating oil drain lines that extend to exterior of enclosure, with internal drain valves.
    b. External radiator-fill provision.
13. Provide motorized louvers to minimize air flow through enclosure when generator set is not operating. Louvers shall include provisions to prevent accumulation of ice or snow that might prevent operation.
14. Inlet ducts shall include rain hoods.

15. Sound Attenuation:
    a. Provide with sound-attenuated housing which allows generator set to operate at full rated load in an ambient temperature of up to 100 degrees F.
    b. Enclosure shall reduce sound level of generator set while operating at full rated load to a maximum of 82 dBA at any location 7 meters from generator set in a free field environment when tested in accordance with SAE J1074.
    c. Insulate enclosure with nonhydroscopic materials.

2.10 FACTORY FINISHING

A. Engine Generator Set and Instrument Panel: Factory-applied primer and two finish coats of manufacturer's standard heat-resistant engine paint.

2.11 FACTORY TESTS

A. General: Conform to NFPA 110.

B. Steady Load Test: Test engine generator set at steady load run of 60 minutes minimum duration at 100 percent full-rated load.

C. Transient Load Test: Conduct transient load test to demonstrate ability to meet load pickup and load release requirements specified.

D. Harmonic Test: Conduct at full load conditions.

E. Record and Report:

1. Strip chart recording and full harmonic analysis measuring up to 50th harmonic for both voltage and current and three phases simultaneously.
2. Transient response.
3. Load/speed stability.
4. Engine fuel consumption.
5. Power output.
6. Harmonic analysis.

PART 3 EXECUTION

3.01 INSTALLATION

A. Level and securely mount engine generator set in accordance with manufacturer's recommendations.

B. Install in accordance with NECA 404.

C. Where applicable, mount engine generator set on vibration isolators in accordance with isolator manufacturer's recommendations.

3.02 FIELD FINISHING

A. Touchup damaged coating with paint system compatible to existing.

3.03 FIELD TESTS

A. General: Conform to NFPA 110.

B. Performance Test:

1. Perform upon completion of installation.
2. Operate 2 hours minimum.
3. Manufacturer's representative shall make necessary adjustments.
4. Demonstrate ability of engine generator set to carry specified loads.
5. Demonstrate engine generator set safety shutdowns.

C. Test Report: Record and report the following:

1. Electric load on generator.
2. Fuel consumption.
3. Exhaust temperature.
4. Ambient air temperature.
5. Safety shutdown performance results.
6. Noise levels at 7 meters and property line.

D. Post-test Requirements:

1. Make final adjustments.
2. Replace fuel and oil filters.
3. Check belt drive tensions.
4. Demonstrate proper operation of equipment, including automatic operation with control from automatic transfer switch, to Engineer and the ESD electrical staff.

3.04 MANUFACTURER'S SERVICES

A. Manufacturer's Representative: Present at Site or classroom designated by the ESD for minimum person-days listed below, travel time excluded:

1. 1 person-day for installation assistance and inspection.
2. 0.5 person-day for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
3. 0.5 person-day for post-startup training ESD staff.

END OF SECTION

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SECTION 26 36 00
TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes transfer switches rated 600 V and less, including the following:
   1. Automatic transfer switches.

B. Related Sections include the following:
   1. Division 26 Sections “Natural Gas Engine Generators” for generators.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

C. Qualification Data: For manufacturer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section “Operation and Maintenance Data,” include the following:
   1. Features and operating sequences, both automatic and manual.
   2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Source Limitations: Obtain automatic transfer switches through generator supplier.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NEMA ICS 1.

E. Comply with NFPA 70.

F. Comply with NFPA 110.

G. Comply with UL 1008 unless requirements of these specifications are stricter.

1.4 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Automatic Transfer Switches:
      a. ASCO Series 300.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to 70 deg. C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
   1. Switch Action: Double throw; mechanically held in both directions.
   2. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.

H. Factory Wiring: Train and bundle factory wiring and label, consistent with shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in division 16 Section “Identification for Electrical Systems.”
   1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
   2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
   3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

I. Enclosures: NEMA 3R, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, mechanically held in both directions.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

E. Automatic Delayed-Transition Transfer Switches: Pauses or stops in intermediate position to momentarily disconnect both sources, with transition controlled by programming in the automatic transfer-switch controller. Interlocked to prevent the load from being closed on both sources at the same time.

   1. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals for alternative source. Adjustable from zero to six seconds, and factory set for one second.
   2. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
   3. Fully automatic break-before-make operation with center off position.
   4. Fully automatic break-before-make operation with transfer when two sources have near zero phase difference.

F. Automatic Transfer-Switch Features:
   1. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
   2. Transfer switches indicated as service-entrance rated shall be provided with a neutral-to-ground main bonding jumper to meet UL service entrance

requirements. Ground fault protection shall be provided for all switches rated 1000 amperes or more applied on 480Y/277 Vac systems in accordance with NEC Article 230-95.

3. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
4. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
5. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
6. Time Delay for Retransfer to Normal source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
7. Test Switch: Simulate normal-source failure.
8. Switch-Position Pilot Lights: Indicate source to which load is connected.
9. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency –source sensing circuits.
    a. Normal Power Supervision: Green light with nameplate engraved “Normal Source Available.”
    b. Emergency Power Supervision: Red light with nameplate engraved “Emergency Source Available.”
10. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
11. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicated override status.
12. Engine Starting contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
13. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
14. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 30-day exercise cycle, 30-minute running period, and 5-minute cool-down period. Exerciser features include the following:
    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.

c. Integral battery operation of time switch when normal control power is not available.

2.4 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Floor-Mounting Switch: Anchor to floor by bolting.
1. Concrete Bases: 4 inches high, reinforced, with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support.

B. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Ground equipment according to Division 26 Section “Electrical.”

B. Connect wiring according to Division 26 Section “Electrical.”

3.3 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Tests and Inspections:
1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer’s specified minimum resistance.
a. Check for electrical continuity of circuits and for short circuits.
b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
c. Verify that manual transfer warnings are properly placed.
d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.
    d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
    f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
    a. Verify grounding connections and locations and ratings of sensors.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contract resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

E. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below.

B. Coordinate this training with that for generator equipment.

END OF SECTION

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   b. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   c. A572/A572A, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
   d. A588/A588M, Standard Specification for High-Strength Low-Alloy Structural Steel, with 50 ksi [345 MPa] Minimum Yield Point to 4-in. [100-mm] Thick.
   e. A595/A595M, Standard Specification for Steel Tubes, Low-Carbon or High-Strength Low-Alloy, Tapered for Structural Use.
   f. A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   g. A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
   h. D6576, Standard Specification for Flexible Cellular Rubber Chemically Blown.
   i. G154, Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.
2. American Wood Protection Association (AWPA): M6, Brands Used on Forest Products.
3. Illuminating Engineering Society of North America (IESNA): HB-9, Lighting Handbook.
4. The Institute of Electrical and Electronics Engineers, Inc. (IEEE): C2, National Electrical Safety Code.
5. Military Specification (MIL): DTL-83420M, Wire Rope, Flexible, for Aircraft Control, General Specification for.
6. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
   b. ICS 6, Industrial Control and Systems: Enclosures.
7. National Energy Policy Act.

8. National Fire Protection Association (NFPA): 70, National Electrical Code.
9. Rural Utilities Service (RUS): 1728F-700, Specification for Wood Poles, Stubs and Anchor Logs.
10. Underwriters Laboratories, Inc. (UL):
    a. 595, Standard for Safety Marine-Type Electric Lighting Fixtures.
    b. 844, Standard for Luminaires for Use in Hazardous (Classified) Locations.
11. U.S. Environmental Protection Agency and U.S. Department of Energy: Energy Star.

1.02 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.

B. Standard Products:

1. Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship.
2. Products shall have been in satisfactory commercial or industrial use for 2 years prior to Bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.
3. Material and Equipment Manufacturing Date: Products manufactured more than 3 years prior to date of delivery to Site shall not be used.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Aluminum Poles:

1. Manufacturer's standard provision shall be made for protecting the finish during shipment and installation. Minimum protection shall consist of spirally wrapping each pole shaft with protective paper secured with tape, and shipping small parts in boxes.
2. Do not store poles on ground.

3. Support poles so they are at least 1 foot above ground level and growing vegetation.
4. Do not remove factory-applied pole wrappings until just before installing pole.
5. Ship poles with bolt circle template, base cover, handhold cover, and shaft cap or tenon.

PART 2 PRODUCTS

2.01 LUMINAIRES

A. General:

1. Component Access: Accessible and replaceable without removing luminaire from its mounting.

B. Exterior Installations:

1. UL Labeled: “SUITABLE FOR WET LOCATIONS.”
2. Ballast: Removable, prewired.
3. When factory-installed photo cells are provided, entire assembly shall have UL label.

C. Hazardous Classified Areas:

1. UL Labeled: Class I, Division 1, Groups C and D. or Class II, Division 1, Groups F and G as applicable.
2. Fixture Enclosure and Fittings: Copper-free, cast aluminum in accordance with UL 844.

D. Lamps:

1. High-Intensity Discharge:
   a. Type: High-pressure sodium and metal halide.
   b. Color: Color corrected.
2. Manufacturers:
   a. General Electric Company.
   b. Osram Sylvania.
   c. Phillips Lighting Company.

2.02 LIGHTING CONTACTOR

A. Features:

1. Mechanically held contactor.
2. Provide contactor with hand-off-automatic selector switch.
3. Contactor shall be hermetically sealed.

2.03 PHOTOCELL SWITCH

A. Features:

1. Automatic ON/OFF switching photo control.
2. Housing: Self-contained, die-cast aluminum, unaffected by moisture, vibration, or temperature changes.
3. Setting: ON at dusk and OFF at dawn.
4. Time delay feature to prevent false switching.
5. Field adjustable to control operating levels.
6. Manufacturers:
   a. Tork.
   b. Paragon Electric Company.

2.04 POLES

A. General:

1. Design for wind load, while supporting luminaires and other appurtenances. The effective projected areas (EPA) of luminaires and appurtenances used in calculations shall be specific for the actual products provided on each pole.
2. Poles 40 feet and shorter shall be one piece construction.
3. Pole Height: As determined by designer.
4. Handhole:
   a. Poles shall have oval-shaped handhole having a minimum clear opening of 2.5 inches by 5 inches.
   b. Cover shall be secured by stainless steel captive screws.
   c. Metal poles shall have internal grounding connection accessible from handhole near bottom of each pole.
5. Scratched, stained, chipped, or dented poles shall not be installed.

B. Aluminum Poles:

1. Manufactured of corrosion-resistant aluminum alloys. Seamless extruded or spun seamless type with minimum 0.188-inch wall thickness.
2. Shape: Round.
3. Provide pole grounding connection designed to prevent electrolysis when used with copper ground wire.
4. Shaft Top: Fitted with cap.
5. Base:
   a. Anchor bolt mounted and machined to receive lower end of shaft.
   b. Joint between shaft and base shall be welded.
   c. Base cover shall be cast aluminum alloy.
   d. Hardware, except anchor bolts, shall be either anodized aluminum alloy or stainless steel.
   e. Handhole.

6. Provide pole cast-in-place foundations with galvanized steel anchor bolts, threaded at the top end and bent 90 degrees at the bottom end.
7. Provide base covers to match pole and galvanized nuts and washers for anchor bolts.

2.05 POLE FOUNDATIONS

A. Anchor Bolts: Steel rod having a minimum yield strength of 50,000 psi; the top 12 inches of the rod shall be galvanized.

B. Concrete: As specified in Section 03 30 00, Cast-in-Place Concrete.

2.06 FACTORY FINISH

A. Electrical equipment shall have factory-applied painting systems which shall, as a minimum.

PART 3 EXECUTION

3.01 INSTALLATION

A. Electrical installations shall conform to IEEE C2 and requirements specified herein.

B. Aluminum Poles: Install according to pole manufacturer's instructions.

1. Provide cast-in-place concrete base.
2. Provide branch circuit in-line fuses in pole base handhole.

C. High Mast Lighting: Install according to manufacturer's instructions.

D. Photocell Switch Aiming: Mount and aim switch according to manufacturer's recommendations.

E. Grounding: Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures in accordance with the standards and requirements of NFPA 70, National Electric Code and Institute of Electrical and Electronics Engineers (IEEE). Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.02 FIELD QUALITY CONTROL

A. Upon completion of installation, verify equipment is properly installed, connected, and adjusted. Conduct an operating test to show equipment operates in accordance with the requirements of this section.

3.03 CLEANING

A. Remove labels and markings, except UL listing mark.

B. Wipe luminaries inside and out to remove construction dust.

C. Clean luminaire plastic lenses with antistatic cleaners only.

D. Touchup painted surfaces of luminaries and poles with matching paint ordered from manufacturer.

E. Replace defective lamps at time of Substantial Completion.

END OF SECTION

DIVISION 31

EARTHWORK

SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.01 DEFINITIONS

A. Interfering or Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.

B. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface.

C. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 2-inch caliper to a depth of 6 inches below subgrade.

D. Scalping: Removal of sod without removing more than upper 3 inches of topsoil.

E. Stripping: Removal of topsoil remaining after applicable scalping is completed.

F. Project Limits: Areas, as shown or specified, within which Work is to be performed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Clear, grub, and strip areas actually needed for waste disposal, borrow, or Site improvements within limits shown or specified.

B. Do not injure or deface vegetation that is not designated for removal.

3.02 CLEARING

A. Clear areas within limits shown on the Design Drawings.

B. Fell trees so that they fall away from facilities and vegetation not designated for removal.

C. Cut off shrubs, brush, weeds, and grasses to within 2 inches of ground surface.

3.03 GRUBBING

A. Grub areas within limits shown on the Design Drawings.

3.04 SCALPING

A. Do not remove sod until after clearing and grubbing is completed and resulting debris is removed.

B. Scalp areas within limits shown on the Design Drawings.

3.05 STRIPPING

A. Do not remove topsoil until after scalping is completed.

B. Strip areas within limits to minimum depths shown on the Design Drawings. Do not remove subsoil with topsoil.

3.06 DISPOSAL

A. Clearing and Grubbing Debris: Dispose of debris offsite.

B. Scalpings: As specified for clearing and grubbing debris.

C. Strippings:

1. Dispose of strippings that are unsuitable for topsoil or that exceed quantity required for topsoil offsite.
2. Stockpile topsoil in sufficient quantity to meet Project needs. Dispose of excess strippings as specified for clearing and grubbing.

END OF SECTION

SECTION 31 22 13
SUBGRADE PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Work and testing required for preparing subgrade.

B. Related sections:
1. Section 31 11 00 – Site Preparation.
2. Section 31 23 16 – Excavation.
3. Section 31 23 23.13 – Fill and Backfill.

1.2 REFERENCE STANDARDS

A. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)

1.3 DEFINITIONS

A. Optimum Moisture Content: As defined in Section 31 23 23.13, FILL AND BACKFILL.

B. Prepared Ground Surface: Ground surface after completion of clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and scarification and compaction of subgrade.

C. Relative Compaction: As defined in Section 31 23 23.13, FILL AND BACKFILL.

D. Relative Density: As defined in Section 31 23 23.13, FILL AND BACKFILL.

E. Subgrade: Layer of existing soil after completion of clearing, grubbing, scalping of topsoil prior to placement of fill, roadway structure or base for floor slab.

F. Standard Specifications: The latest edition, including supplements of the Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction.

G. SEQUENCING AND SCHEDULING

H. Complete applicable Work specified in Sections 31 11 00, SITE PREPARATION and 31 23 16, EXCAVATION, prior to preparation.

1.4 QUALITY ASSURANCE

A. Notify Engineer when subgrade is ready for compaction or whenever compaction is resumed after a period of extended inactivity.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Prepare subgrade when unfrozen and free of ice and snow.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. Keep subgrade free of water, debris, and foreign matter during compaction or proof-rolling.

B. Bring subgrade to proper grade and cross-section and uniformly compact surface.

C. Do not use sections of prepared ground surface as haul roads. Protect prepared from traffic.

D. Maintain prepared ground surface in finished condition until next course is placed.

3.2 MOISTURE CONDITIONING

A. Dry Subgrade: Add water, then mix to make moisture content uniform throughout.

B. Wet Subgrade: Aerate material by blading, discing, harrowing, or other methods, to hasten drying process.

3.3 TESTING

A. Test roll subgrade as specified in Standard Specifications to detect soft or loose subgrade or unsuitable material, as determined by Engineer.

3.4 CORRECTION

A. Soft or Loose Subgrade:
   1. Adjust moisture content and recompact, or
   2. Over excavate as specified in Section 31 23 16, EXCAVATION, and replace with suitable material from the excavation, as specified in Section 31 23 23.13, FILL AND BACKFILL

END OF SECTION

SECTION 31 23 16
EXCAVATION

PART 1 GENERAL

1.01 QUALITY ASSURANCE

A. Provide adequate survey control to avoid unauthorized over excavation.

1.02 WEATHER LIMITATIONS

A. Material excavated when frozen or when air temperature is less than 32 degrees F shall not be used as fill or backfill until material completely thaws.

B. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

1.03 SEQUENCING AND SCHEDULING

A. Clearing, Grubbing, and Stripping: Complete applicable Work prior to excavating.

B. Dewatering: Conform to applicable requirements of Section 31 23 19, Dewatering, prior to initiating excavation.

C. Excavation Support: Install and maintain, in accordance with the requirements of OSHA, local and state regulations to ensure the safety of workers, support sides of excavations and prevent detrimental settlement and lateral movement of existing facilities, adjacent property, and completed Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Excavate to lines, grades, and dimensions shown and as necessary to accomplish Work. Excavate to within tolerance of plus or minus 0.1 foot, except where dimensions or grades are shown or specified as maximum or minimum. Allow for forms, working space, granular base, topsoil, and similar items, wherever applicable. Trim to neat lines where concrete is to be placed.

B. Do not over excavate without written authorization of Engineer. In the event of over excavation backfill with Granular Backfill in accordance with Section 31 23 23, Trench Backfill.

C. Where constructing within fill the services of a geotechnical engineer shall be employed to ensure that the material has been properly placed and compacted to prevent settlement of the main, manhole or structure.

3.02 UNCLASSIFIED EXCAVATION

A. Excavation is unclassified. Complete all excavation regardless of the type, nature, or condition of the materials encountered.

3.03 TRENCH WIDTH

A. Minimum Width of Trenches:

1. 18 inches greater than outside diameter or width of the pipe.
2. Increase trench widths by thicknesses of sheeting/excavation support system where system is required.

B. Maximum Trench Width: Unlimited, unless otherwise shown or specified, or unless excess width will cause damage to existing facilities, adjacent property, or completed Work.

3.04 EMBANKMENT AND CUT SLOPES

A. Shape, trim, and finish cut slopes to conform with lines, grades, and cross-sections shown, with proper allowance for topsoil or slope protection, where shown.

B. Remove stones and rock that exceed 3-inch diameter and that are loose and may roll down slope. Remove exposed roots from cut slopes.

C. Round tops of cut slopes in soil to not less than a 6-foot radius, provided such rounding does not extend offsite or outside easements and rights-of-way, or adversely impacts existing facilities, adjacent property, or completed Work.

3.05 STOCKPILING EXCAVATED MATERIAL

A. Stockpile excavated material that is suitable for use as fill or backfill until material is needed.

B. Confine stockpiles to within easements, rights-of-way, and approved work areas. Do not obstruct roads or streets.

C. Do not stockpile excavated material adjacent to trenches and other excavations, unless excavation side slopes and excavation support systems are designed, constructed, and maintained for stockpile loads.

D. Do not stockpile excavated materials near or over existing facilities, adjacent property, or completed Work, if weight of stockpiled material could induce excessive settlement.

3.06 DISPOSAL OF SPOIL

A. Dispose of excavated materials, which are unsuitable or exceed quantity needed for fill or backfill, offsite.

END OF SECTION

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SECTION 31 23 19
DEWATERING

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Dewatering of excavations and other work sites including trench, and tunnel excavations.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Continuously control water during course of construction, including weekends and holidays and during periods of work stoppages, and provide adequate backup systems to maintain control of water.

3.02 SURFACE WATER CONTROL

A. Remove surface runoff controls when no longer needed.

3.03 DEWATERING SYSTEMS

A. Permit, provide, operate, and maintain dewatering systems of sufficient size and capacity to permit excavation and subsequent construction in dry and to lower and maintain groundwater level a minimum of 2 feet below the lowest point of excavation. Continuously maintain excavations free of water, regardless of source, and until backfilled to final grade.

B. Provide sufficient redundancy in each system to keep excavation free of water in event of component failure.

C. Provide supplemental ditches and sumps only as necessary to collect water from local seeps. Do not use ditches and sumps as primary means of dewatering.

END OF SECTION

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SECTION 31 23 21
FILL AND BACKFILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Work and materials required for fill and backfill for all excavations other than trench type excavations.

B. Related sections:
1. Section 03 30 00 – Cast-In-Place Concrete.
2. Section 31 11 00 – Site Preparation.
3. Section 31 22 13 – Subgrade Preparation.
4. Section 31 23 16 – Excavation.
5. Section 31 23 23.16 – Trench Backfill.
6. Section 32 11 00 – Base Course.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:
1. American Society for Testing and Materials (ASTM):
   a. ASTM C117, Standard Test Method for Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.
   b. ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   c. ASTM D75, Standard Practice for Sampling Aggregates.
   d. ASTM D698, Standard Test Methods for Laboratory Characteristics of Soil Using Modified Effort (12,400 ft-lbf/ft^3).
   e. ASTM D1556, Standard Test Method for Density of Soil in Place by the Sand Cone Method.
   f. ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3).
   g. ASTM D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
   h. ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   i. ASTM D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

1.3 DEFINITIONS

A. Relative Compaction:
1. Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D698.

2. Apply corrections for oversize material to either as-compacted field dry density or maximum dry density, as determined by Engineer.

B. Optimum Moisture Content:
   1. Determined in accordance with ASTM D698 specified to maximum dry density for relative compaction.
   2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

C. Relative Density: Calculated in accordance with ASTM D4254 based on maximum index density determined in accordance with ASTM D4253 and minimum index density determined in accordance with ASTM D4254.

D. Prepared Ground Surface: Ground surface after completion of required demolition, clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and preparation.

E. Completed Course: A course or layer that is ready for next layer or next phase of Work.

F. Lift: Loose (uncompacted) layer of material.

G. Geosynthetics: Geotextiles, geogrids, or geomembranes.

H. Well-Graded:
   1. A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes.
   2. Does not define numerical value that must be placed on coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.
   3. Used to define material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

I. Influence Area: Area within planes sloped downward and outward at 60-degree angle from horizontal measured from:
   1. 1-foot outside outermost edge at base of foundations or slabs.
   2. 1-foot outside outermost edge at surface of roadways or shoulder.
   3. 0.5-foot outside exterior at spring line of pipes or culverts.

J. Borrow Material: Material from required excavations or from designated borrow areas on or near site.

K. Selected Backfill Material/Earthfill: Materials available onsite that Engineer determines to be suitable for specific use.

L. Imported Material: Materials obtained from sources suitable for specified use.

M. Structural Fill: Fill materials as required under structures, pavements, and other facilities.

N. Embankment Material: Fill materials required to raise existing grade in areas other than under structures.

O. Standard Specification: The latest edition, including supplements of the Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction.

1.4 SUBMITTALS

A. Quality Control Submittals:
   1. Catalog and manufacturer's data sheets for compaction equipment.
   2. Certified test results from independent testing agency.

1.5 QUALITY ASSURANCE

A. Notify Engineer when:
   1. Structure is ready for backfilling, and whenever backfilling operations are resumed after a period of inactivity.
   2. Soft or loose subgrade materials are encountered wherever embankment or site fill is to be placed.
   3. Fill material appears to be deviating from Specifications.

1.6 SEQUENCING AND SCHEDULING

A. Complete applicable Work specified in Sections 02 41 00, DEMOLITION; 31 11 00, SITE PREPARATION; 31 23 16, EXCAVATION; and 31 22 13, SUBGRADE PREPARATION, prior to placing fill or backfill.

B. Backfill against concrete structures only after concrete has attained compressive strength, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE. Obtain acceptance of concrete work and attained strength prior to placing backfill.

C. Backfill around water-holding structures only after completion of satisfactory leakage tests as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

D. Do not place granular base, subbase, or surfacing until after subgrade has been prepared as specified in Section 31 22 13, SUBGRADE PREPARATION.

PART 2 - PRODUCTS

2.1 SOURCE QUALITY CONTROL

A. Gradation Tests: It will be the Contractor’s responsibility to conduct testing as necessary to locate acceptable sources of imported material.

2.2 EARTHFILL

A. Excavated material from required excavations, free from rocks larger than 3 inches, from roots and other organic matter, ashes, cinders, trash, debris, and other deleterious materials.

2.3 GRANULAR FILL

A. Crushed Stone material shall conform with the requirements of the applicable sections of the ALDOT Standard Specifications and shall consist of clean, hard and durable particles or fragments, free from dirt, vegetation or objectionable materials. Two classes of crushed stone may be referred to as follows:
   1. Class I – ALDOT No. 78 Aggregate
   2. Class II – Dense Graded Aggregate (DGA)

2.4 WATER FOR MOISTURE CONDITIONING

A. Free of hazardous or toxic contaminates, or contaminants deleterious to proper compaction.

2.5 BASE COURSE ROCK

A. As specified in Section 32 11 00, BASE COURSE.

2.6 FOUNDATION STABILIZATION ROCK

A. Crushed rock or pit run rock.

B. Uniformly graded from coarse to fine.

C. Free from excessive dirt and other organic material.

D. Maximum 2-1/2 inches particle size.

PART 3 - EXECUTION

3.1 GENERAL

A. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill and backfill materials.

B. Place and spread fill and backfill materials in horizontal lifts of uniform thickness, in a manner that avoids segregation, and compact each lift to specified densities prior to placing succeeding lifts. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water.

C. During filling and backfilling, keep level of fill and backfill around each structure and buried tank even.

D. Do not place fill or backfill, if fill or backfill material is frozen, or if surface upon which fill or backfill is to be placed is frozen.

E. If pipe, conduit, duct bank, or cable is to be laid within fill or backfill:
   1. Fill or backfill to an elevation 2 feet above top of item to be laid.
   2. Excavate trench for installation of item.
   3. Install bedding, if applicable, as specified in Section 31 23 23.16, TRENCH BACKFILL.
   4. Install item.
   5. Backfill envelope zone and remaining trench, as specified in Section 31 23 23.16, TRENCH BACKFILL, before resuming filling or backfilling specified in this section.

F. Tolerances:
   1. Final Lines and Grades: Within a tolerance of 0.1-foot unless dimensions or grades are shown or specified otherwise.
   2. Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not permitted.

G. Settlement: Correct and repair any subsequent damage to structures, pavements, curbs, slabs, piping, and other facilities, caused by settlement of fill or backfill material.

H. Fill and backfill materials shall be conditioned to a water content that is within 2 percentage points (plus or minus) of the optimum required for compaction as determined by ASTM D698.

3.2 BACKFILL UNDER AND AROUND STRUCTURES

A. Under Facilities: Within influence area beneath structures, slabs, pavements, curbs, piping, conduits, duct banks, and other facilities, backfill with granular fill, unless otherwise shown. Place granular fill in lifts of 6-inch maximum thickness and compact each lift to minimum of 98 percent of the soil's standard Proctor maximum dry density in accordance with ASTM D698, except for the top one foot, which should be compacted to 100 percent standard Proctor maximum dry density.

B. Subsurface Drainage: Backfill with granular drain material, where shown. Place granular drain material in lifts of 6-inch maximum thickness and compact each lift to minimum of 90 percent relative density.

C. Other Areas: Backfill with earthfill to lines and grades shown, with proper allowance for topsoil thickness where shown. Place in lifts of 6-inch maximum thickness and compact each lift to minimum 95 percent relative compaction as determined in accordance with ASTM D698, Method C.

3.3 FILL

A. Outside Influence Areas Beneath Structures, Tanks, Pavements, Curbs, Slabs, Piping, and Other Facilities: Unless otherwise shown, place earthfill as follows:
   1. Allow for 6-inch thickness of topsoil where required.
   2. Maximum 9-inch thick lifts.
   3. Place and compact fill across full width of embankment.
   4. Compact to minimum 95 percent relative compaction as determined in accordance with ASTM D698, Method C.
   5. Dress completed embankment with allowance for topsoil, crest surfacing, and slope protection, where applicable.

3.4 SITE TESTING

A. Gradation:
   1. One sample from each 400 tons of finished product or more often as determined by Engineer, if variation in gradation is occurring, or if material appears to depart from Specifications.
   2. If test results indicate material does not meet Specification requirements, terminate material placement until corrective measures are taken.
   3. Remove material placed in Work that does not meet Specification requirements.

B. In-Place Density Tests: In accordance with ASTM. During placement of materials, test as follows:
   1. One test per 5,000 ft^2, minimum 3 tests per lift.
   2. One test per lift per 50 lineal feet of roadway or trench.
   3. A minimum of two tests on granular fill beneath structures.
   4. A minimum of two test per 300 cubic yards during backfilling of walls.

C. Testing shall be the Contractor's responsibility and conducted by persons experienced in such work.

3.5 GRANULAR BASE, SUBBASE, AND SURFACING

A. Place and Compact as specified in Section 32 11 00, BASE COURSE.

3.6 REPLACING OVEREXCAVATED MATERIAL,

A. Replace excavation carried below grade lines shown or established by Engineer as follows:
   1. Beneath Footings: Concrete of strength equal to that of respective footing.
   2. Beneath Fill or Backfill: Same material as specified for overlying fill or backfill.
   3. Beneath Slabs-On-Grade: Granular fill.
   4. Trenches:

a. Unauthorized Overexcavation: Either trench stabilization material or granular pipe base material, as specified in Section 31 23 23.16, TRENCH BACKFILL.
b. Authorized Overexcavation: Trench stabilization material, as specified in Section 31 23 23.16, TRENCH BACKFILL.

5. Permanent Cut Slopes (Where Overlying Area is Not to Receive Fill or Backfill):
   a. Flat to Moderate Steep Slopes (3: 1, Horizontal Run: Vertical Rise or Flatter): Earthfill.
   b. Steep Slopes (Steeper than 3: 1):

Correct overexcavation by transitioning between areas and designed slope adjoining areas, provided such cutting does not extend offsite or outside easements and right-of-ways, or adversely impacts existing facilities, adjacent property, or completed Work.

Backfilling overexcavated areas is prohibited unless, in opinion, backfill will remain stable, and overexcavated material is replaced as compacted earth fill.

END OF SECTION

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SECTION 31 23 23
TRENCH BACKFILL

PART 1 GENERAL

1.01 SUMMARY

A. Where required, modify the backfill requirement to meet local / state requirements.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Public Works Association (APWA): Uniform Color Code.
2. ASTM International (ASTM):
   a. C33/C33M, Standard Specification for Concrete Aggregates.
   b. C94/C94M, Standard Specification for Ready-Mixed Concrete.
   c. C117, Standard Test Method for Materials Finer than 75 Micrometer (No. 200) Sieve in Mineral Aggregates by Washing.
   d. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   e. C150/C150M, Standard Specification for Portland Cement.
   f. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
   g. C1012/C1012M, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution.
   h. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
   i. D1140, Standard Test Methods for Amount of Material in Soils Finer than No. 200 (75 micrometer) Sieve.
   j. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   k. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   l. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   m. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   n. D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
   o. D4832, Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

3. National Electrical Manufacturers Association (NEMA): Z535.1, Safety Colors.

1.03 DEFINITIONS

A. Base Rock: Granular material upon which manhole bases and other structures are placed.

B. Bedding Material: Granular material upon which pipes, conduits, cables, or duct banks are placed.

C. Imported Material: Material obtained by Contractor from source(s) offsite.

D. Lift: Loose (uncompacted) layer of material.

E. Pipe Zone: Backfill zone that includes full trench width and extends from prepared trench bottom to an upper limit above top outside surface of pipe, conduit, cable or duct bank.

F. Prepared Trench Bottom: Graded trench bottom after excavation and installation of stabilization material, if required, but before installation of bedding material.

G. Relative Compaction: The ratio, in percent, of the as-compacted field dry density to the laboratory maximum dry density as determined by ASTM D698. Corrections for oversize material may be applied to either as-compacted field dry density or maximum dry density, as determined by Engineer.

H. Relative Density: As defined by ASTM D4253 and ASTM D4254.

I. Selected Backfill Material: Material available onsite that the Owner/Owner's Representative determines to be suitable for a specific use.

J. Well-Graded: A mixture of particle sizes that has no specific concentration or lack thereof of one or more sizes producing a material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids. Satisfying both of the following requirements, as defined in ASTM D2487:

1. Coefficient of Curvature: Greater than or equal to 1 and less than or equal to 3.
2. Coefficient of Uniformity: Greater than or equal to 4 for materials classified as gravel, and greater than or equal to 6 for materials classified as sand.

PART 2 PRODUCTS

2.01 MARKING TAPE

A. Detectable:

1. Solid aluminum foil, visible on unprinted side, encased in protective high visibility, inert polyethylene plastic jacket.
2. Foil Thickness: Minimum 0.35 mils.
3. Laminate Thickness: Minimum 5 mils.
4. Width: 3 inches.
5. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.
6. Joining Clips: Tin or nickel-coated furnished by tape manufacturer.
7. Manufacturers and Products:
    a. Reef Industries; Terra Tape, Sentry Line Detectable.
    b. Mutual Industries; Detectable Tape.
    c. Presco; Detectable Tape.

B. Color: Green in accordance with APWI Uniform Color Code.

2.02 TRACER WIRE

A. Material: Minimum 12-gauge solid copper or copper jacket with a steel core, with high-density polyethylene (HDPE) or high-molecular weight polyethylene (HMWPE) insulation suitable for direct bury.

B. Splices: Use wire nut or lug suitable for direct burial as recommended by tracer wire manufacturer.

C. Manufacturers:

1. Copperhead Industries, LLC.
2. Performance Wire & Cable Inc.
3. Pro-line Safety Products Company.

2.03 TRENCH STABILIZATION MATERIAL

A. Base Rock: Number 1 in accordance with the Course Aggregate Gradation Table, ALDOT Standard Specifications.

B. Granular Backfill: Number 57 or 67 in accordance with the Course Aggregate Gradation Table, ALDOT Standard Specifications.

2.04 BEDDING MATERIAL AND PIPE ZONE MATERIAL

A. Number 57 or 67 in accordance with the Course Aggregate Gradation Table, ALDOT Standard Specifications.

2.05 CLASS C - EARTH BACKFILL

A. Soil, loam, or other excavated material suitable for use as backfill.

B. Free from roots or organic matter, refuse, boulders and material larger than 1/2 cubic foot, or other deleterious materials.

2.06 CLASS A - PROCESSED EARTH BACKFILL

A. Class C Earth backfill, meeting the following additional requirement.

1. Free of boulders and cobbles that would be retained on a 6-inch screen 3-inch sieve.

2.07 FLOWABLE FILL

A. As specified in Section 31 23 25, Flowable Fill.

2.08 CONCRETE BACKFILL

A. Class C Concrete as specified in Section 03 30 00, Cast-in-Place Concrete.

2.09 GRAVEL SURFACING ROCK

A. Number 67 in accordance with the Course Aggregate Gradation Table, ALDOT Standard Specifications.

2.10 TOPSOIL

A. Natural, friable, sandy loam, obtained from well-drained areas, free from objects larger than 1-1/2 inches maximum dimension, and free of subsoil, roots, grass, other foreign matter, hazardous or toxic substances, and deleterious material that may be harmful to plant growth or may hinder grading, planting, or maintenance.

B. Composition: In general accordance with ASTM D5268:

1. Gravel-Sized Fraction: Maximum 5 percent by weight retained on a No. 10 sieve.
2. Sand-Sized Fraction: Minimum 20 to 60 percent passing No. 10 sieve.
3. Silt and Clay-Sized Fraction: Minimum 35 to 70 percent.

C. Organic Matter: Minimum 1.5 percent by dry weight as determined in accordance with ASTM D2974.

D. pH: Range 5.0 to 7.0.

E. Textural Amendments: Amend as necessary to conform to required composition by incorporating sand, peat, manure, or sawdust.

PART 3 EXECUTION

3.01 TRENCH PREPARATION

A. Water Control:

1. As specified in Section 31 23 19, Dewatering.
2. Remove water in a manner that minimizes soil erosion from trench sides and bottom.
3. Provide continuous water control until trench backfill is complete.

B. Remove foreign material and backfill contaminated with foreign material that falls into trench.

3.02 TRENCH BOTTOM

A. Firm Subgrade: Grade with hand tools, remove loose and disturbed material, and trim off high areas and ridges left by excavating bucket teeth. Allow space for bedding material if shown or specified.

B. Soft Subgrade: If subgrade is encountered that may require removal to prevent pipe settlement, notify Owner/Owner's Representative. Owner/Owner's Representative will determine depth of overexcavation, if any required.

3.03 TRENCH STABILIZATION MATERIAL INSTALLATION

A. Rebuild trench bottom with trench stabilization material.

B. Place material over full width of trench in 6-inch lifts to required grade, providing allowance for bedding thickness.

C. Compact each lift so as to provide a firm, unyielding support for the bedding material prior to placing succeeding lifts.

3.04 BEDDING

A. Furnish imported bedding material where, in the opinion of Owner/Owner's Representative, excavated material is unsuitable for bedding or insufficient in quantity.

B. Place over full width of prepared trench bottom in two equal lifts when required depth exceeds 8 inches.

C. Hand grade and compact each lift to provide a firm, unyielding surface.

D. Minimum Thickness: As follows, except increase depths listed by 2 inches in areas of rock excavation:

1. Pipe 18 Inches and Smaller: 4 inches.

E. Check grade and correct irregularities in bedding material. Loosen top 1 inch to 2 inches of compacted bedding material with a rake or by other means to provide a cushion before laying each section of pipe, conduit, direct-buried cable, or duct bank.

F. Install to form continuous and uniform support except at bell holes, if applicable, or minor disturbances resulting from removal of lifting tackle.

G. Bell or Coupling Holes: Excavate in bedding at each joint to permit proper assembly and inspection of joint and to provide uniform bearing along barrel of pipe or conduit.

3.05 BACKFILL PIPE ZONE

A. Upper limit of pipe zone shall not be less than 12 inches:

B. Restrain pipe as necessary to prevent their movement during backfill operations.

C. Place material simultaneously in lifts on both sides of pipe and, if applicable, between pipes, conduit, cables, and duct banks installed in same trench.

1. Pipe 10-Inch and Smaller Diameter: First lift less than or equal to 1/2 pipe diameter.
2. Pipe Over 10-Inch Diameter: Maximum 6-inch lifts.

D. Thoroughly tamp each lift, including area under haunches, with handheld tamping bars supplemented by “walking in” and slicing material under haunches with a shovel to ensure voids are completely filled before placing each succeeding lift.

E. Each lift shall be compacted with a minimum of two passes by either a vibratory plate compactor. Take care to avoid damaging pipe and pipe coating.

3.06 MARKING TAPE INSTALLATION

A. Continuously install detectable marking tape along centerline of buried piping, on top of last lift of pipe zone material.

1. Detectable Marking Tape: Install with nonmetallic piping and waterlines.

3.07 TRACER WIRE INSTALLATION AND TESTING

A. Install tracer wire continuously along centerline of all force main buried at a depth greater than 10 feet.

B. Attach wire to top of pipe using tape at maximum of 10-foot intervals. In areas where depth of cover is excessive for allowing detection of tracer wire

with electronic pipe locator, install tracer wire within pipe backfill directly above pipe centerline at a minimum depth of 3 feet.

C. Install splices in accordance with manufacturer's instructions for direct bury applications. Tie ends of wire to be joined in a knot as required to reduce tension on splice.

D. Bring tracer wire to surface at each valve box, curb box, vault, air valve, blowoff valve, hydrant, and pipeline marker. Tracer wire shall be brought to surface at least every 1,000 feet. If distance between pipe appurtenances exceeds 1,000 feet, install valve box to allow access to tracer wire. Mark valve box cover with the word "TRACER". Coil enough excess tracer wire at each appurtenance to extend wire 12 inches above ground.

E. Test continuity of tracer wire using electronic pipe locator in presence of Owner prior to paving.

3.08 BACKFILL ABOVE PIPE ZONE

A. General:

1. Process excavated material to meet specified gradation requirements.
2. Adjust moisture content as necessary to obtain specified compaction.
3. Do not allow backfill to free fall into trench or allow heavy, sharp pieces of material to be placed as backfill until after at least 2 feet of backfill has been provided over top of pipe.
4. Do not use power driven impact type compactors for compaction until at least 4 feet of backfill is placed over top of pipe.
5. Backfill to grade with proper allowances for topsoil, crushed rock surfacing, and pavement thicknesses, wherever applicable.
6. Backfill around structures with same class backfill as specified for adjacent trench, unless otherwise shown or specified.

B. Class A Processed Earth Backfill:

1. Place in lifts not exceeding thickness of 9 inches.
2. Mechanically compact each lift to a minimum of 95 percent relative compaction prior to placing succeeding lifts.

C. Class C Earth Backfill:

1. Backfill with earth backfill.
2. Leave trench with backfill material neatly mounded across the entire trench width, but not more than 6 inches above the adjacent ground surface.
3. In lawn, garden, or similar type areas, maintain trench level with the existing adjacent grade.
4. At Other Locations:

a. Estimate and provide amount of backfill material required so that after normal settlement, settled surface will match adjacent ground surface.
b. Neatly windrow material over trench, and remove excess.
c. Correct excess or deficiency of backfill material apparent after settlement and within correction period by regrading, and disposing of excess material or adding additional material where deficient.

D. Class D Backfill: Backfill trench above pipe zone with granular backfill in lifts not exceeding 8 inches. Compact each lift to a minimum of 95 percent relative compaction prior to placing succeeding lifts.

E. Concrete Backfill:

1. Place above bedding.
2. Minimum Concrete Thickness: 6 inches on top and sides of pipe.
3. Do not allow dirt or foreign material to become mixed with concrete during placement.
4. Allow sufficient time for concrete to reach initial set before additional backfill material is placed in trench.
5. Prevent flotation of pipe.
6. Begin and end concrete backfill within 4 inches of a pipe joint on each end.
7. Do not encase pipe joints except within the limits of the concrete backfill.

F. Controlled Low Strength Material:

1. Discharge from truck mounted drum type mixer into trench.
2. Place in lifts as necessary to prevent uplift (flotation) of new and existing facilities.
3. In traveled areas fill entire trench section to pavement finish grade for a temporary driving surface, and screed off excess and finish with a float.
4. In other areas fill trench section as shown.

3.09 REPLACEMENT OF TOPSOIL

A. Replace topsoil in top 12 inches of backfilled trench.

B. Maintain finished grade of topsoil even with adjacent area and grade as necessary to restore drainage.

3.10 MAINTENANCE OF TRENCH BACKFILL

A. After each section of trench is backfilled, maintain surface of backfilled trench even with adjacent ground surface until final surface restoration is completed.

B. Gravel Surfacing Rock: Add gravel surfacing rock where applicable and as necessary to keep surface of backfilled trench even with adjacent ground surface, and grade and compact as necessary to keep surface of backfilled trenches smooth, free from ruts and potholes, and suitable for normal traffic flow.

C. Topsoil: Add topsoil where applicable and as necessary to maintain surface of backfilled trench level with adjacent ground surface.

D. Other Areas: Add excavated material where applicable and keep surface of backfilled trench level with adjacent ground surface.

3.11 SETTLEMENT OF BACKFILL

A. Settlement of trench backfill, or of fill, or facilities constructed over trench backfill will be considered a result of defective compaction of trench backfill.

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SECTION 31 23 25
FLOWABLE FILL

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, equipment, materials, and services, including pumping equipment and application, necessary for the manufacture, transportation, and placement of all cementitious flowable fill as shown on the Contract Drawings or as ordered by the Engineer, except for the work specifically included under other items.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 30 00 – Cast-in-Place Concrete

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Division 1, the Contractor shall submit the following:

1. Shop Drawings

2. Certifications of specification compliance for all sources of each material

3. Manufacturer's data on all admixtures

4. Mix design and trial mix test results

5. Aggregate gradation

1.04 QUALITY CONTROL

A. The Contractor shall engage the services of a testing laboratory that possesses the qualifications required by Section 03300 – Cast-In-Place Concrete and is experienced in the design and testing of flowable fill materials and mixes to perform material evaluation tests and to design mixes for flowable fill. A trial mix shall be performed to verify the flowable fill mix design. The trial mix shall also report slump, air content, yield, cement content, and dry unit weight per ASTM C143 and ASTM D6023.

PART 2 – MATERIALS

2.01 CEMENTITIOUS FLOWABLE FILL

A. Flowable fill (controlled low strength material) shall be a uniform mixture of sand, Type II Portland cement, fly ash, admixtures, and water. The mix design shall produce a flowable material with little or no bleed water that has a minimum compressive strength of 50 psi and a maximum compressive strength of 100 psi at 56 days. The cured material shall be excavatable and shall have a maximum dry weight of 100 pounds per cubic foot. Slump of mix at the point of application shall be 7 inches to 10 inches.

B. Admixtures specifically designed for flowable fill shall be used to improve flowability, reduce unit weight, control strength development, reduce settlement, and reduce bleed water. Admixtures shall be Rheocell-Rheofill by BASF Construction Chemicals, Darafill by Grace Construction Products, or Engineer-approved equal. Cement and all other materials shall be as specified in Section 03300 – Cast-In-Place Concrete.

C. Fine aggregate (sand) shall consist of natural or manufactured siliceous sand that is clean and free from deleterious substances and is graded within the following limits:

Sieve Size	Percent Passing by Weight
3/8-inch	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100*	2 to 10

*For manufactured sand, the percent passing the No. 100 Sieve may be increased up to 20 percent.

PART 3 – EXECUTION

3.01 PLACEMENT OF FLOWABLE FILL

A. Flowable fill shall be batched and premixed by an approved producer, dispensed from ready-mix trucks, and placed by approved methods and equipment.

B. Flowable fill shall be placed so as to completely fill the space to receive it with no trapped air pockets or other voids. Positive means of allowing the air to escape shall be provided where necessary and after approval by the Engineer. Where placed against, around, and inside existing structures, lift heights shall be limited so as not to overload the structure. The Engineer shall approve lift heights and procedures. Specific procedures and methods shall be included in the Contractor's Shop Drawing submittals.

C. Where flowable fill is placed around piping and other elements subject to floating within the fill space, positive means shall be taken to provide temporary balancing loads to prevent uplift, or fill lift heights shall be limited to prevent uplift.

D. Application of loads or placement of other fill materials or concrete on top of flowable fill shall not occur until the flowable fill surface is determined to be suitable for loading per ASTM D6024, subject to the approval of the Engineer.

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SECTION 31 32 00
SLOPE PROTECTION AND EROSION CONTROL

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor is responsible for implementing best management practices (BMPs) to prevent and minimize erosion and resultant sedimentation in all cleared and grubbed areas during and after construction. This Specification Section covers the work necessary for the installation of structures and measures for the prevention and control of soil erosion. The Contractor shall furnish all material, labor, and equipment necessary for the proper installation, maintenance, inspection, monitoring, reporting, and removal (where applicable) of erosion prevention and control measures in conformance with and subject to the limitations of the latest edition of the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas and as required by the State NPDES General Permit.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 10 00 –Site Clearing

B. Section 31 70 00 – Final Grading and Landscaping

PART 2 -- PRODUCTS

2.01 GENERAL

A. The requirements specified herein and shown in the Contract Documents are minimum requirements for the preventing or minimizing soil erosion and sediment transport. Contractor shall install and maintain soil erosion and sediment control measures in accordance with the following criteria. Requirements set forth in the latest edition of the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas shall govern in case of conflicting information, unless clearly identified as a deviation from the Manual.

2.02 CONSTRUCTION EXITS

A. Construction exits are stone-stabilized pads underlain with geotextile fabric located at any point where traffic will be leaving a construction site to a public right-of-way, street, alley, sidewalk, or parking area.

2.03 SEDIMENT STRUCTURES

A. Sediment basins, ponds, and traps, are prepared storage areas constructed to trap and store sediment from erodible areas in order to protect properties and stream channels below the construction areas from excessive siltation.

2.04 CHECK DAMS

A. Check dams are barriers composed of logs and poles, large stones, or other materials placed across a natural or constructed drain way.

2.05 TEMPORARY SEEDING AND MULCHING

A. Temporary seeding and mulching are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All cut and fill slopes, including waste sites and borrow pits, shall be seeded when and where necessary to control erosion.

2.06 BALED HAY OR STRAW CHECKS

A. Baled hay or straw erosion checks are temporary measures to control erosion and prevent siltation. Bales shall be either hay or straw, containing five (5) cubic feet or more of material.

B. Baled hay or straw checks shall be used where the existing ground slopes toward or away from the embankment along the toe of slopes, in ditches, or other areas where siltation erosion or water run-off is a problem.

2.07 TEMPORARY SILT FENCES

A. Silt fences are temporary measures utilizing woven wire or other approved material attached to posts with filter cloth composed of burlap, plastic filter fabric, etc., attached to the upstream side of the fence to retain the suspended silt particles in the run-off water.

2.08 RIPRAP

A. Stone for riprap shall be of the size and weight designated on drawings. In addition, the stones shall be durable and of a suitable quality to ensure permanence in the structure and in the climate in which they are to be used. It shall be free of cracks, seams, and other defects that would intend to increase unduly its deterioration from natural causes. Not more than five percent of the stones shall have shale seams, which would tend to separate when exposed to weathering. The inclusion of objectionable quantities of dirt, sand, clay, or rock fines will not be permitted.

B. Precast concrete grids "Monoslabs" or Engineer-approved equal, may be used in lieu of riprap stone for slope protection. The Contractor shall submit in writing to the Engineer, for approval, what materials he desires to use for slope protection.

2.09 ROLLED EROSION CONTROL MAT (RECM)

A. Rolled erosion control mat (RECM) is a protective covering (blanket) or soil stabilization mat used to establish permanent vegetation on steep slopes, channels, or shorelines.

B. RECM shall be composed of either clean wheat straw, curled wood, or coconut fiber covered with a synthetic mesh.

PART 3 -- EXECUTION

3.01 GENERAL

A. The Contractor shall obtain an NPDES permit in accordance with requirements of this section and in compliance with regulations established by the EPA and the ADEM.

B. It is a condition of this Contract that the Contractor exercise planning and forethought in coordinating the Work of protecting the project and adjoining properties from soil erosion by effective and continuous erosion control methods of either a temporary or a permanent nature.

C. Prior to construction, the Contractor shall meet with the Owner and/or Engineer and go over in detail the expected problem areas in regard to the erosion control work. Different solutions shall be discussed so that the best method might be determined. It is the basic responsibility of the Contractor to develop an erosion control plan acceptable to the Owner and Engineer.

D. Before beginning work on the site, the Contractor shall submit to the Engineer, for his review and approval, a plan for control of soil erosion.

E. The Contractor shall plan his clearing work and his entire construction operations in such a manner as to effectively control soil erosion and prevent pollution of streams, ponds, and/or drains as would result from silt or soil runoff or as would result from any materials used in the construction operations such as oil, grease, paints, chemicals, or any construction debris.

F. The Contractor shall intercept and block drainage from the construction site by means of silt fences, silt barriers, and sedimentation pools as required.

G. Silt fences, wherever used on the site, shall consist of hay bales securely fastened in place or of approved permeable-barrier fabric designed to filter water and retain silt. Fabric shall be set securely in the ground and firmly held in place.

H. The erosion control work shall cover all disturbed areas within the sewer right-of-way and/or easement along which the sewer has been installed. Erosion control work shall not be limited to the easement but shall include all disturbed areas as necessary.

I. Areas to receive riprap, or special slope protection materials, shall be graded to the lines and slopes shown on the Drawings, or as directed by the Owner or Engineer. Any loose material shall be compacted by the use of hand or mechanical tampers.

3.02 METHODS OF CONSTRUCTION

A. The Contractor shall use any of the acceptable methods necessary to control soil erosion and prevent the flow of sediment to the maximum extent possible. These methods shall include, but not be limited to, the use of water diversion structures, diversion ditches, and settling basins.

B. Construction operations shall be restricted to the areas of work indicated on the Drawings and to the area which must be entered for the construction of temporary or permanent facilities. The Owner and Engineer have the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow, and fill operations and to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of the wetlands and adjacent watercourses. Such work may involve the construction of temporary dikes, dams, sediment basins, and use of temporary mulches, mats, or other control devices or methods as necessary to control erosion.

C. Excavated soil material shall not be placed adjacent to wetlands or watercourses in a manner that will cause it to be washed away by high water or runoff. Earth berms or diversions shall be constructed to intercept and divert runoff water away from critical areas. Diversion outlets shall be stable or shall be stabilized by means acceptable to the Owner and Engineer. If for any reason construction materials are washed away during the course of construction, the Contractor shall remove those materials from the fouled areas as directed by the Owner or Engineer at no cost to the Owner.

D. For work within easements, all materials used in construction such as excavation, backfill, roadway, and equipment shall be kept within the limits of the easements.

E. The Contractor shall not pump silt-laden water from trenches or other excavations into wetlands or adjacent watercourses. Instead, silt-laden water from excavations shall be discharged within areas surrounded by baled hay or into sediment traps to ensure that only sediment-free water is returned to the watercourses. Damage to vegetation by excessive watering or silt accumulation in the discharge area shall be avoided.

F. Prohibited construction procedures include, but are not limited to, the following:

1. Dumping of spoil material into any streams, wetlands, surface waters, or unspecified locations.

2. Indiscriminate, arbitrary, or capricious operation of equipment in wetlands or surface

waters.

3. Pumping of silt-laden water from trenches or excavations into surface waters or wetlands.

4. Damaging vegetation adjacent to or outside of the construction area limits.

5. Disposal of trees, brush, debris, paints, chemicals, asphalt products, concrete curing compounds, fuels, lubricants, insecticides, washwater from concrete trucks or hydroseeders, or any other pollutant in wetlands, surface waters, or unspecified locations.

6. Permanent or unauthorized alteration of the flow line of any stream.

7. Open burning of debris at the construction work

G. Any temporary working roadways required shall be clean fill approved by the Owner and/or Engineer. In the event fill is used, the Contractor shall take every precaution to prevent the fill from mixing with native materials of the site. All such foreign fill materials shall be removed from the site following construction.

3.03 EROSION CHECKS

A. The Contractor shall furnish and install baled hay or straw erosion checks in all locations as indicated on the Drawings, surrounding the base of all deposits of stored excavated materials outside of the disturbed area, and where indicated by the Owner or Engineer. Checks, where indicated on the Drawings, shall be installed immediately after the site is cleared and before trench excavation is begun at the locations indicated. Checks around stored material shall be located approximately six (6) feet from the material. Bales shall be held in place with two (2) inch by two (2) inch by three (3) foot wooden stakes. Each bale shall be butted tightly against the adjoining bale to preclude short circuiting of the erosion check.

3.04 MAINTENANCE OF EROSION CONTROL FEATURES

A. The temporary erosion control features installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.

B. In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of Work as scheduled, and are ordered by the Owner or Engineer, such work shall be performed by the Contractor at his own expense.

3.05 SPECIAL SLOPE PROTECTION

A. The work covered by this section consists of furnishing all materials, equipment, and labor and performing all necessary operations in connection with the installation of riprap, or other special slope protection, as called for on the Drawings, or as directed by the Owner or Engineer.

B. Areas to receive riprap, or special slope protection materials, shall be graded to the lines and slopes shown on the Drawings, or as directed by the Owner or Engineer. Any loose material shall be compacted by the use of hand or mechanical tampers.

C. Just prior to placing riprap, or other slope protection material, the Contractor shall install a Type II separator geotextile. Type II separator geotextile shall be a woven slit film or monofilament synthetic fabric consisting of polyester or polypropylene. The geotextile shall be treated to resist degradation due to exposure to ultraviolet light and shall have a Survivability Class of Class 1 in accordance with AASHTO M288. Minimum overlap of adjacent rolls of geotextile shall be 18 inches, and minimum transverse end overlap of geotextile shall be 24 inches. Type II separator geotextile shall meet the following properties:

PROPERTY	VALUE
Geotextile Construction	Woven
Mass per Unit Area (Unit Weight), ASTM D5261 (oz/yd^2)	N/A
Ultraviolet Resistance, (500 hrs) ASTM D4355, Average % Strength Retention	70
Grab Tensile Strength (lbs), ASTM D4632	$390^{(1)}X250^{(2)}$
Grab Tensile Elongation (%) ASTM D4632	20 MAX
Wide Width Tensile Strength, (lbs/inch) ASTM D4595	N/A
Trapezoid Tear Strength (lbs) ASTM D4533	100
Apparent Opening Size (AOS), (mm), ASTM D4751	0.4
Permittivity at 50 mm constant head (sec^{-1}), ASTM D4491	0.1
Puncture Resistance, ASTM D6241 (lbs)	950

*** MINIMUM AVERAGE ROLL VALUE (MARV)**

(1) Warp Direction

(2) Fill Direction

The geotextile shall be approved by the Owner and/or Engineer for installation and shall then be installed in strict accordance with the manufacturer's specifications for installation and

use. Only then, and with the approval of the Owner and/or Engineer, shall the slope protection material be installed on the geotextile.

3.06 CONSTRUCTION RUNOFF PERMITTING

A. It shall be the responsibility of the Contractor to determine if a State NPDES General Permit ALR100000 for construction site runoff is required as part of this project. Application for coverage is made by submittal of a Notice of Intent (NOI) and a permit fee to:

ADEM -Water Division Industrial Branch
1400 Coliseum Blvd.
Montgomery, Alabama 36110
Telephone (334) 271-7700

B. The construction general permit requires the Contractor to use BMPs to control storm water runoff. The general permit requires inspections on monthly basis to ensure compliance with State water quality standards. On site precipitation must also be recorded.

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SECTION 31 40 00
BORE/TUNNEL CROSSINGS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The work covered by this Section consists of the construction of casing and carrier pipe across State highway rights-of-way and/or streams/creeks as detailed on the Drawings and described in these Specifications. Casing pipe shall be of steel construction bored and jacked into its location by conventional bore and jack methods. All ALDOT roadways shall be tunnel and jacked consisting of jacking pipe and hand-mining inside the casing. Casing pipe shall be welded at joints and be straight across alignment indicated on the Drawings.

B. The Contractor shall furnish all labor, material, equipment, and incidental items necessary to excavate the bore pit and complete the work as shown on the Drawings and as specified herein.

C. The Contractor shall perform any general excavation and boring required prior to placing casing pipe. Material resulting from boring shall be disposed of by the Contractor in a suitable manner.

D. The Contractor shall provide all necessary access including access ladders, ramps, etc. to bore pit prior to the commencement of the boring and jacking operations.

E. The Contractor shall furnish the names of all subcontractors which he proposes to use for this work including necessary evidence and/or experience records. The Contractor or subcontractor performing the boring and jacking construction shall have a minimum of three (3) years experience in boring and jacking casing pipe on similar projects of similar pipe diameters.

F. The highway crossings shall comply with standards set forth in the "Policies and Procedures for Accommodating Utilities on Highway Rights of Way" from the AL. Department of Transportation, Division of Highways (Latest Revision), and the "Standard Specifications for Highway Bridges" from AASHTO (Latest Revision).

G. The materials covered by these Specifications are intended to be standard materials of proven reliability and as manufactured by reputable manufacturers having experience in the production of such materials. The materials furnished shall be designed, constructed, and installed in accordance with the best practices and methods.

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1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Division 31 – Earthwork

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Requirements and Division 1, the Contractor shall submit the following:

1. Casing pipe shop drawings and material data from casing pipe manufacturer.

2. Bore pit excavation details including footprint drawing of bore pit, design and calculations for any sheeting or shoring utilized signed and sealed by a professional engineer registered in the State of Alabama.

3. Construction sequence plan including drilling, casing, and grouting placement procedures.

4. Casing Spacer manufacturer's data and shop drawings.

5. Experience qualifications of contractor or subcontractor.

PART 2 -- MATERIALS

2.01 STEEL CASING PIPE

A. Steel casing pipe interior diameter shall be as indicated on the Drawings or shall, in all cases, be great enough to afford easy removal of the carrier pipe without disturbing the casing pipe or roadbed. The casing pipe shall be smooth wall or spiral welded steel pipe. Casing pipe shall be leak-proof construction and be capable of withstanding highway or railroad loadings where applicable. Casing pipe shall be steel pipe in sizes 12-inches and larger manufactured from steel having a minimum yield stress strength of 35,000 psi and shall have a minimum wall thickness as indicated in the following table: The minimum pipe size and wall thickness shall be as indicated on the Contract Drawings. All joints shall be butt welded with a full depth, single "V" groove weld. The casing pipe shall conform to ASTM A 139, Grade B (without hydro-test) or ASTM A53, Grade B (without hydro-test), and AWWA C200-75 The carrier pipe shall be Ductile Iron restrained joint pipe as specified in Section 15006, unless otherwise noted herein or as shown on the contract drawings.

B. Upon completion of carrier pipe installation, annular space between casing and carrier pipe shall be filled with grout and sealed at each end with a masonry wall.

2.02 TUNNEL LINER PLATE – (NOT USED)

2.03 GROUT

A. Grout shall be composed of Portland Cement and sand in the proportion specified in the Contract Documents and the minimum amount of water necessary to obtain the desired consistency. If no proportion is indicated, cement grout shall consist of one part Portland Cement to three parts sand. Water amount shall be as required to achieve desired consistency without compromising strength requirements. White portland cement shall be mixed with the Portland Cement as required to match color of adjacent concrete. The minimum compressive strength at 28 days shall be 4000 psi. For beds thicker than 1-1/2 inch and/or where free passage of grout will not be obstructed by coarse aggregate, 1-1/2 parts of coarse aggregate having a top size of 3/8 inch should be added. This stipulation does not apply for grout being swept in by a mechanism. These applications shall use a plain cement grout without coarse aggregate regardless of bed thickness. Sand shall conform to the requirements of ASTM C144. Contractor or boring sub-contractor may use admixture approved by the engineer to allow workability of grout at his option and not additional cost to the Owner.

B. Non-shrink grout shall conform to CRD-C 621 and ASTM C 1107, Grade B or C when tested at a maximum fluid consistency of 30 seconds per CDC 611/ASTM C939 at temperature extremes of 45°F and 90°F and an extended working time of 15 minutes. Grout shall have a minimum 28-day strength of 7,000 psi. Non-shrink grout shall be, "Euco N-S" by the Euclid Chemical Company, "Sikagrout 212" by Sika Corporation, Conspec 100 Non-Shrink Non-Metallic Grout by Conspec.

2.04 CASING SPACERS

A. Contractor shall properly install and prevent the carrier pipe from floating by the use of casing spacers. Casing spacers shall be stainless steel, carbon steel, high-density polyethylene or combination thereof. The model of casing spacers shall correspond to the diameter of the carrier pipe and encasement pipe. Casing spacers shall fasten tightly onto the carrier pipe so that when the carrier pipe is being installed, the spacers will not move along the carrier pipe. Casing spacer placement along the carrier pipe shall be in accordance with the manufacturer’s recommendations, minimum three spacers per pipe joint. Maximum distance between casing spacer and internal wall of casing pipe shall be 2-inches. The proposed procedure to install the carrier pipe is to “bell-up” the pipe outside the casing and push the carrier pipe through the casing. Casing spacers shall be manufactured by Advance Products and Systems, Cascade Waterworks Mfg. Co., Pipeline Seal and Insulator, Public Works Marketing, or approved equal.

2.05 CONCRETE CRADLE

A. Concrete cradles shall be installed at the low end of each bore and jack as indicated in the details on the Contract Drawings. Cradle shall be roughly formed around the pipe so as to

provide a smooth bearing surface. Concrete cradles shall be constructed of Class B concrete.

2.06 BORE PIT

A. Bore pits shall be excavated and backfilled in accordance with Section 02200 – Earthwork and meet all federal and state OSHA requirements for a safe excavation. Bore pits shall be located so as to not undermine pavements or railroad tracks and ballast.

2.07 MASONRY WALL

A. One (1) course of standard brick and mortar masonry wall shall be constructed at each end of casing pipe, flush with casing pipe opening, once carrier pipe is installed. Brick shall have a nominal size 2-1/4 inches by 3-3/4 inch by 8 inch. Mortar shall be one part Portland cement blended with three parts sand (100% passing #4 sieve and minimum 95% passing No. 8 sieve) and have a minimum 7-day compressive strength of 500 psi. Prepared bag mixes are acceptable if approved by the Engineer.

PART 3 -- EXECUTION

3.01 INSTALLATION- GENERAL

A. The Contractor shall be responsible for the design, adequacy and methodology of the bored and jacked casing pipe installation. The Contractor shall submit the proposed method of installation, detailed layout information, methods to be implemented if unusual or adverse soil conditions (i.e.: running sand, water, etc.) are encountered during installation. Design certifications for installation method shall be sealed and signed by a professional engineer registered in the State of North Carolina to the Engineer for submittal to the N.C. Department of Transportation, Special Design Services prior to starting work. Where soils indicate a mixed face condition which indicates it would be difficult to maintain alignment, approval from NCDOT will be required not to use a full face tunnel shield.

B. The Contractor shall have the option of providing, either a bored and jacked casing pipe installation or a combination of both at the location(s) and in conformance with the lines and grades, shown on the Drawings.

C. If a combination of casing and tunnel is required, details of the proposed junction shall be submitted to and approved by the ALDOT and the Engineer.

D. The recommended methods and details shown on the Drawings and specified herein, are intended to indicate the minimum acceptable standard of quality required for the casing/tunnel installation. Other methods of installation, based on acceptable industry standards and techniques, may be acceptable for the installation. Under no conditions shall jetting or wet boring of the casing/tunnel be allowed.

E. All excavations and pits shall be well sheeted and braced as necessary for safe and adequate access for workmen, inspections, and materials and shall be of a size suitable to equipment and material handling requirements.

F. All of the Contractors plans, specifications and design computations for pit shoring shall be sealed and signed by a Professional Engineer registered in the State of Alabama.

G. All pits required for the installation of the casing/tunnel and located within ALDOT right-of-way shall be completely isolated from the roadway traffic with precast concrete barriers installed in accordance with the ALDOT standards.

3.02 BORING AND JACKING

A. Boring and jacking installations shall be jacked through dry bores slightly larger than the pipe bored progressively ahead of the leading edge of the advancing pipe as spoil is mucked by the auger back through the pipe. As the dry boring operation progresses, each new section of the casing pipe shall be 360° butt-welded, using a full depth, single "V" groove weld, to the next section previously jacked into place.

B. The boring equipment to be used for installing the jacked casing shall be of such size and capacity to allow the boring to proceed in a safe and expeditious manner. The installation of the casing and boring of the hole shall be done as rapidly as possible and shall be done simultaneously to avoid voids, cave-ins or settlement and for safety of traffic above.

C. A special lubricant may be used to facilitate movement or lessen the danger of jacked pipe from freezing.

D. If voids are encountered or occur outside the casing pipe, grout holes shall be installed in the top section of the casing pipe at 4 foot (maximum) centers and the voids filled with 1:3 Portland Cement to sand grout with sufficient water added to produce a flowable mixture and at sufficient pressure to prevent settlement. **The Contractor shall be prepared to bore through weathered or partially weathered rock, if encountered, with a specialized bit or hand-mine.** Costs associated with this provision shall be deemed as included in the Unit Price Bid for each location and no additional payment will be made.

F. In the event an obstruction is encountered during the boring and jacking operation, and the casing pipe is at least 30-inches in diameter, the auger shall be withdrawn and the obstruction removed. If a bolder is encountered and is removed by blasting or other approved method, the void shall be filled with grout, as previously specified. No blasting shall be permitted until a detailed blasting plan is submitted to and approved by the ALDOT, and the Engineer.

3.03 TUNNEL AND JACK

A. For tunnel and jack installation, casing shall be jacked through the soil progressively ahead of the leading edge of the advancing pipe as soil is hand-mined and mucked back through the pipe. As the tunnel and jack operation progresses, each new section of the casing pipe shall be 360° butt-welded, using a full depth, single "V" groove weld, to the next section previously jacked into place.

B. The jacking equipment to be used for installing the jacked casing shall be of such size and capacity to allow the tunneling to proceed in a safe and expeditious manner. The installation of the casing shall be done as rapidly as possible and shall be done simultaneously to avoid voids, cave-ins or settlement and for safety of traffic above.

C. A special lubricant may be used to facilitate movement or lessen the danger of jacked pipe from freezing.

D. If voids are encountered or occur outside the casing pipe, grout holes shall be installed in the top section of the casing pipe at 4 foot (maximum) centers and the voids filled with 1:3 Portland Cement to sand grout with sufficient water added to produce a flowable mixture and at sufficient pressure to prevent settlement. **The Contractor shall be prepared to tunnel and jack through weathered or partially weathered rock, if encountered, with hand-mining.** Costs associated with this provision shall be deemed as included in the Unit Price Bid for each location and no additional payment will be made.

F. In the event an obstruction is encountered during the tunnel and jacking operation, the obstruction shall be removed. If a bolder is encountered and is removed by blasting or other approved method, the void shall be filled with grout, as previously specified. No blasting shall be permitted until a detailed blasting plan is submitted to and approved by the ALDOT, and the Engineer.

3.04 CASING/TUNNEL ALIGNMENT

A. The Contractor shall check the vertical and horizontal alignment of the casing/tunnel by survey instrument at least once during each four feet of advance, or as directed by the Engineer.

3.05 CARRIER PIPE CRADLE INSTALLATION

A. Following completion of the tunnel excavation and grouting operations, a concrete pipe cradle shall be formed and poured as shown on the Drawings. The forms shall be constructed of wood, poured into place with concrete at a spacing adequate to support the carrier pipe. The forms shall be placed such that they produce a true cradling channel whereby the pipe shall be skidded into place on its required alignment and grade. In lieu of the wood cradle, adequately designed and spaced pipe alignment guides (spiders) may be used to slide the pipe along the concrete pipe cradle. The concrete pipe cradle can be eliminated when using a casing pipe with pipe alignment guides.

3.06 CARRIER PIPE INSTALLATION

A. For all casing installations the carrier pipe shall be installed with adequately designed and spaced pipe alignment guides "spiders", secured, and bulkheaded as shown on the Drawings. The proposed procedure to install the carrier pipe is to "bell-up" the pipe outside the casing and push the carrier pipe through the casing.

B. Following completion of the casing installation, the carrier pipe shall be installed, secured, bulkheaded, as shown on the Drawings. The proposed procedure to install "push-on" type carrier pipe is one joint at a time, skidding it into place. Upon reaching the proper stationing, the pipe spigot shall be jacked up to the appropriate grade and wood blocking shall be placed under it and the pipe shall be belled up. Wood blocking to prevent flotation shall be placed at the pipe crown and springline locations. The proposed procedure to install "restrained joint" type carrier pipe is to "bell-up" the pipe outside the tunnel and push the carrier pipe through the tunnel. Blocking to prevent flotation shall be attached to the casing/tunnel prior to the installation of the restrained joint carrier pipe. Stationing of the blocking shall be such that when the pipe installation is complete, the blocks are located at the pipe bells. Blocking shall be set so that as the pipe slides through the tunnel, the pipe bells will have a clearance of $\pm$1/2". In lieu of the wood cradle, adequately designed and spaced pipe alignment guides may be used to slide the carrier pipe along the concrete pipe cradle.

C. Concrete brick and mortar bulkheads with air and water vent holes shall be constructed at the terminal ends of the casing/tunnel.

D. In addition, a Class B concrete cradle shall be provided from the end of the casing/tunnel bulkhead to the first pipe joint outside the casing/tunnel.

3.07 SURFACE SETTLEMENT MONITORING

A. Prior to the beginning of any casing/tunnel excavation, a surface settlement monitoring grid system shall be installed on the highway/railroad. This grid shall consist of PK nails installed along the tunnel centerline at ten foot intervals. Additional lines of PK nails shall be installed ten feet each side of the centerline. These points shall be initially read and the elevations recorded prior to the start of the casing/tunnel construction. If no visible settlement is occurring during casing/tunnel excavations, these points shall be read only at such times as the Contractor's surveyor is present to transfer the line and grade into the casing/tunnel. These points shall be checked and elevations recorded on a daily basis, until the casing/tunnel installation is completed.

3.08 SPECIAL CONSTRUCTION REQUIREMENTS FOR EXISTING EASEMENTS AND RIGHTS OF WAY

A. Refer to Special Conditions for encroachment requirements when working within existing easements and or rights of way.

- END OF SECTION -

SECTION 31 70 00
FINAL GRADING AND LANDSCAPING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Furnish all labor, equipment, and materials necessary for final grading, topsoiling, seeding, and miscellaneous site work not included under other Sections, but required to complete the Work as shown on the Drawings and specified herein. Under this Section, all areas of the project site disturbed by excavation, materials storage, temporary roads, etc., shall be reseeded as specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01510 – Temporary Utilities

B. Section 31 32 00 – Slope Protection and Erosion Control

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01300 – Submittals:

1. Product data

2. Certification of all materials

3. Three (3) copies of composition and germination certification and test results for grass seed

PART 2 -- PRODUCTS

2.01 CONTRACTOR'S RESPONSIBILITIES

A. Furnish and submit certification for the materials used as specified in the General Conditions, Division 1 – General Requirements, and Division 31 – Earthwork.

2.02 TOPSOIL

A. Upon completion and approval of the rough grading, the Contractor shall place the topsoil over all areas disturbed during construction under any contract, except those areas which will be paved, graveled, or rip rapped. Topsoil shall not be placed in a frozen or muddy condition and shall contain no toxic materials harmful to grass growth.

2.03 WATER

A. Contractor shall provide water in accordance with the requirements of Section 01510 – Temporary Utilities.

B. The Contractor shall furnish all hoses and connections necessary to complete the landscaping work.

2.04 FERTILIZER

A. Fertilizer shall be a complete commercial fertilizer with components derived from commercial sources. Fertilizer analysis shall be determined from field soil sampling in appropriate numbers taken by the Contractor and analyzed by the Alabama Department of Agriculture and Industries or other independent laboratory. Contractor shall furnish fertilizer in accordance with the recommendations of the Alabama Department of Agriculture and Industries. Fertilizer shall conform to the standards of the Association of Official Agricultural Chemists and when tested by their current methods, shall comply with Alabama Fertilizer Laws, Title 2, Section 282-300, Alabama Code of 1940, as amended.

B. Nitrogen may be derived from any nitrogen-containing material approved by the State Commissioner of Agriculture and Industries. Available Phosphoric Acid shall be free from superphosphate, bone, or tankage.

C. Fertilizer shall be delivered in standard size bags marked with the weight, analysis of contents, and the name of the manufacturer. Containers used to transport fertilizer shall be commonly used for the transport of such fertilizers and shall ensure proper protection and handling of the fertilizer. Fertilizer shall be stored in weatherproof storage areas and in such a manner that its effectiveness will not be impaired.

D. Manufactured fertilizer shall be standard commercial products and shall contain not less than the percentages by weight (mass) of the ingredients in the following table:

TYPE	Nitrogen (N)	Phosphorus (P_2O_5)	Potash (K_2O)
15-0-15	15		15
13-13-13	13	13	13
10-10-10	10	10	10
8-8-8	8	8	8
0-14-14	0	14	14
4-12-12	4	12	12
4-16-8	4	16	8
Super Phosphate		18.0	
Ammonium Nitrate	33.5		

Ammonium Sulphate	20.5		
Sodium Nitrate	16.0		
Potassium Chloride			60.0

E. An allowance of +/- 5 percent variation or tolerance of the above proportions shall be permitted based on relative commercial value.

2.05 LIME

A. At least 50 percent shall pass a No. 60 U.S.S. mesh sieve, and 90 percent shall pass a No. 10 U.S.S. mesh sieve. Calcium Carbonate shall not be less than 90 percent.

2.06 GRASS SEED

A. The Contractor shall furnish the kinds and amounts of seed to be seeded in all areas disturbed by the construction work. Each bag of seed shall bear a tag or label bearing the seal of the Official Seed Certifying Agency to show that it meets the requirements of the Alabama Seed Law. All seed must have been tested within six (6) months immediately preceding the planting of such material on the job.

B. The inoculant for treating legume seed shall be a pure culture of nitrogen-fixing bacteria prepared specifically for the species. Inoculants shall not be used later than the date indicated on the container.

C. Seed shall be at least 95 percent pure seed of the required type. Seed for Lespedezas shall have a minimum germination rate of 80 percent, and seed for all other species shall have a minimum germination rate of 85 percent.

D. Bermudagrass may be either hulled or unhulled as indicated in the following seed mixture tables, Sericea Lespedeza shall be hulled and scarified, and Annual Lespedeza (Kobe), White Dutch Clover, and Reseeding Crimson Clover shall be hulled. Coated seeds will not be accepted for planting.

E. Seed containing prohibited noxious weed seed shall not be accepted. Seed shall be in conformance with Alabama Seed Law restrictions for restricted noxious weeds.

F. Seed mixes to be used on the Project shall be mixtures of the types of seeds shown in the following tables. The required weights indicated in the tables are the actual seed weights as delivered and take into account the minimum required percentages of pure seeds and minimum required germination rates.

1. Seed mixes designated for “AREAS SUBJECT TO FREQUENT MOWING” shall be used on roadway shoulders, medians, and front slopes flatter than 3:1 extending 60 feet beyond the edge of pavement or to the toe of the front slope, whichever is

less. All other areas designed for seeding shall be considered to be "AREAS NOT SUBJECT TO FREQUENT MOWING".

TEMPORARY SEEDING Required Pounds Per Acre (#/ac) of Pure Live Seed			
Date of Planting	1/1 – 4/15	4/16 – 8/31	9/1 – 12/31
Annual Ryegrass	15		25
Bermudagrass (Hulled)		10	
Kentucky 31 Tall Fescue	30	30	30
Reseeding Crimson Clover	30		10
Brown Top Millet		30	

PERMANENT SEEDING **(IN AREAS SUBJECT TO FREQUENT MOWING)** Required Pounds Per Acre (#/ac) of Pure Live Seed				
Date of Planting	8/16 – 2/29		3/1 – 5/15	5/16 – 8/15
Annual Ryegrass	10 (1)	25 (2)		
Bermudagrass (Hulled)			18	24
Bermudagrass (Unhulled)	30 (1)		12	
Annual Lespedeza (Kobe)				38
White Dutch Clover	5 (1)		6	

Notes:

(1) From 8/16 thru 2/29, Annual Ryegrass, Bermudagrass (Unhulled), and White Dutch Clover are required where vegetation must be established within an area no further than 15 feet from the edge of mainline pavement.

(2) From 8/16 thru 2/29, only Annual Ryegrass is required where vegetation must be established within an area that extends further than 15 feet from the edge of mainline pavement. Seeding in stubble for the establishment of permanent vegetation is required during the following month of March.

PERMANENT SEEDING **(IN AREAS NOT SUBJECT TO FREQUENT MOWING)** Required Pounds Per Acre (#/ac) of Pure Live Seed			
Date of Planting	11/16 – 2/29	3/1 – 8/15	8/16 – 11/15
Annual Ryegrass	15		
Bermudagrass (Hulled)		18	
Bermudagrass (Unhulled)	35	12	18
Kentucky 31 Tall Fescue	35	35	35
Weeping Lovegrass		2	
Sericea Lespedeza (Hulled)		38	38
Sericea Lespedeza (Unhulled)	38		
Reseeding Crimson Clover			29

2.07 MULCHING FOR VEGETATION ESTABLISHMENT

A. Mulch materials shall be furnished in compliance with the requirements given in Article 860.03 of the Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction, latest edition.

1. Hydraulic Mulch: Hydraulic mulch products shall consist of natural fibers with or without tackifier adhesives and/or binding agents. A list of acceptable hydraulic mulch products, mulch control netting and tackifiers (List II-20, "TACKIFIERS, MULCH CONTROL NETTING, AND HYDRAULIC MULCH PRODUCTS") is given in the ALDOT manual titled "Materials, Sources, and Devices with Special Acceptance Requirements". Hydraulic mulch products shall be applied in accordance with the manufacturer's recommendations.

   a. Hydraulic mulch products shall be applied at the rate designated by the manufacturer for the specific slope where they are being applied to provide a solid blanket of the mulch product with no soil showing. In no case shall the applied rate be less than 2,000 pounds per acre.

2. Dry Blown Mulch: Dry blown mulch shall be hay or straw. Hay shall be native hay or Sudan grass, broom straw, coastal bermudagrass, or other materials approved by the Engineer. Straw shall be threshed straw of oats, wheat, or rye. Mulch materials shall not contain an excessive quantity of matured seeds or noxious weeds or a species which would constitute a menace to the planted species and to surrounding farmland. Mulch shall not be too fresh, or excessively brittle, or so decomposed as to retard growth of grass. The moisture content of the mulch shall not exceed 15 percent at the time that the mulch is weighed.

   Dry blown mulch shall be stabilized by crimping, by the application of a tackifier adhesive, or by anchoring with a mulch control netting. Tackifiers shall be used at the manufacturer's recommended rates when chosen for mulch stabilization. Acceptable tackifier adhesives and mulch control netting products are listed on List II-20, "TACKIFIERS, MULCH CONTROL NETTING, AND HYDRAULIC MULCH PRODUCTS" of the ALDOT manual titled "Materials, Sources, and Devices with Special Acceptance Requirements". Asphalt adhesives are not acceptable for use.

   a. Dry blown mulch shall be applied at a rate of not less than 4,000 pounds per acre.

B. Seeded areas shall be covered with mulch within 48 hours after seeding.

2.08 TEMPORARY SOIL STABILIZER

A. The temporary agent for soil erosion control shall consist of an specially-prepared, highly-concentrated powder which, when mixed with water, forms a thick liquid such as "Enviroseal 2001" by Enviroseal Corp., "Terra Control" by Quattro Environmental, Inc., or

"CHEM-CRETE ECO-110" by International CHEM-CRETE Corp. Agent shall have no growth or germination inhibiting factors. The agent shall be used for hydroseeding grass seed in combination with other approved amendments resulting in a highly viscous slurry which, when sprayed directly on the soil, forms a gelatinous crust.

2.09 ROLLED EROSION CONTROL MAT

A. The rolled erosion control mat (RECM) shall be as specified in Section 02270 – Slope Protection and Erosion Control.

2.10 RIPRAP AND HERBICIDES

A. Furnish and install sufficient quantity of landscape gravel or riprap to cover the ground to a minimum 4-inch depth for gravel and 24-inch depth for riprap, unless otherwise noted or indicated on the Drawings. Also furnish and apply an approved herbicide to the subgrade surface just prior to installing the landscape gravel or riprap.

B. During placing, the stone shall be graded so that the smaller stones are uniformly distributed through the mass. The Contractor may place the stone by mechanical methods, augmented by hand placing where necessary or ordered by the Engineer. The placed riprap shall form a properly graded, dense, neat layer of stone.

C. All topsoil and vegetative matter shall be removed from the subgrade surfaces prior to the application of the weed killer (herbicide) and the placement of landscape gravel or riprap. Apply commercial-type herbicide as preemergence control of miscellaneous grasses and broadleaf weeds in granular or liquid form such as "Treflan" or "Dymid". Methods and rates of application shall be in strict compliance with manufacturer's directions and acceptable to the Engineer.

D. The herbicide selected shall be safe for use around ornamental plantings, have long-lasting weed control, and shall be resistant to leaching away under excessive rainfall.

E. A second application of the herbicide shall be made on the surface of the landscape gravel or riprap sometime after the first 6 months but not later than 12 months. Same methods and rates apply as specified previously.

PART 3 -- EXECUTION

3.01 DISPOSITION OF MATERIALS AND STRUCTURES ENCOUNTERED IN THE WORK

A. Existing materials or structures that may be encountered within the lines, grades, or trenching sections established for completion of the Work, if unsuitable or unacceptable to the Engineer for use in the Work, and for which the disposition is not otherwise specified, shall either be disposed of by the Contractor or shall remain the property of the Owner as further provided in this Section.

B. At the option of the Owner, any existing materials or structures of "value" encountered in the Work shall remain the property of the Owner. The term "value" shall be defined by the Owner.

C. Any existing materials or structures encountered in the Work and determined not to be of "value" by the Owner shall be disposed of by the Contractor in an approved manner, except as otherwise specified in Section 02100 – Clearing, Grubbing, and Site Preparation.

3.02 GRADING

A. After approval of the rough grading, the Contractor shall commence his preparations of the subgrade for the various major conditions of the work as follows:

1. Bare soil for rip rap area at subgrade shall be 24 inches below final grade or as directed by the Engineer.

2. For topsoil for lawn and road shoulder seed areas, scarify 2-inch depth of subgrade (4 inches below final grade) prior to placing topsoil.

B. Final surface grading of the topsoiled, landscape graveled, and rip rapped areas shall be mechanically raked or hand raked to an even finished surface alignment.

3.03 TOPSOIL

A. Topsoil shall be spread in place at the quantity required for lawn and road shoulder seed areas at a 4-inch consolidated depth and a sufficient quantity for certain plant beds and backfill for shrubs and trees as specified.

3.04 SEEDBED PREPARATION

A. Contractor shall prepare all areas to receive temporary or permanent seeding measures prior to planting. Ground preparation shall consist of cultivation to a loose depth of approximately 4 inches, minimum, and the application and lime and fertilizer as follows.

B. Topsoil shall be placed in areas to be seeded and roughened with tracked equipment or other suitable measures. Slopes steeper than 3:1 may be roughened by grooving, furrowing, tracking, or stairstep grading. Slopes flatter than 3:1 should be grooved by disking, harrowing, or raking before operating planting equipment on the contour.

C. Permanent Seeding: Soil amendments including, but not limited to, lime and fertilizer shall be spread as follows for initial fertilization of the ground prior to permanent seeding:

1. Soft Soil

a. Lime: Apply at a rate of 4,000 pounds per acre.

b. Fertilizer: Apply a commercial fertilizer that shall provide at least 120 pounds of N, 120 pounds of P_2O_5, and 120 pounds of K_2O per acre, as computed from the nominal contents of fertilizer elements. Only 1/2 of this rate shall be applied when the required seeding is Annual Ryegrass.

2. Rocky or Hardpan Areas: The requirements for planting in rocky or hardpan areas shall apply when the Engineer determines that the area is too rocky or compacted for plowing, disking, and harrowing, but is sufficiently soft or shaley to permit some form of treatment.

a. Initial Soil Amendments: 1/2 of the fertilizer and all of the lime required for the initial fertilization of soft soil shall be applied before the initial scarification.

b. Initial Scarification: The fertilizer and lime shall be worked into the rocky or hardpan area by an initial scarification as directed by the Engineer.

c. Coverage with Topsoil: Approximately 4 inches of topsoil shall be placed over the scarified and fertilized rocky or hardpan area.

d. Soil Amendments After Placement of Topsoil: The second half of the fertilizer required for the initial fertilization of soft soil shall be applied after the placement of the topsoil.

3. Steep Slopes (2H:1V or Steeper)

a. Ground Preparation: Planting operations may proceed without further ground preparation after topsoil spreading and tracking if the planting can be accomplished within 72 hours after the tracking operations. Tracking is the mechanical roughening of the slope surface. Tracking shall be accomplished by the movement upslope and downslope (not along the slope) of heavy equipment that operates on tracks.

b. Initial Soil Amendments: 1/2 of the fertilizer and all of the lime required for the initial fertilization of soft soil shall be applied.

4. Stubble: The seeding in stubble method of planting shall be used to establish permanent species when initial vegetation establishment occurs during a season that is not optimal for the permanent planting. Dates for seeding in stubble are designated in the seed mix tables in Article 2.06.

a. Ground Preparation: This method requires that the existing vegetation be mowed to a height of approximately 3 inches or sprayed with an approved herbicide, or both, to retard further growth. The area shall then be lightly scarified by disking or other approved method to prepare a suitable seedbed.

b. The initial fertilization shall be in accordance with the previous requirements given for this work in soft soil.

D. Temporary Seeding and Mulching: At locations where final grading will not be completed within 60 calendar days, all bare ground shall be stabilized with temporary seeding and mulching.

1. Ground Preparation: Areas to be temporarily seeded shall be left in a rough graded condition. Areas that are smooth or hard shall be lightly scarified with scarifying teeth or some other acceptable method, running perpendicular to the direction of water flow. The intent of this scarifying is to obtain a rough area to hold seed and prevent the formation of rills and gulleys. Areas where sight distances must be maintained shall be bladed smooth. All debris in these areas shall be removed to allow mowing.

2. Fertilizer: Apply 8-8-8 fertilizer at 1,000 pounds per acre.

E. Fertilizers and lime shall be applied uniformly at the required rates of placement. The fertilizer shall be well pulverized and free of lumps when applied. In no case shall fertilizer that is not mixed with soil be permitted to be in direct contact with seed. When fertilizers are applied hydraulically, they shall be sufficiently diluted so that no damage is done to either seed or established vegetation.

3.05 HYDROSEEDING AND GRASS

A. All grassing on State right-of-way shall comply with Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction, latest edition.

B. After the area around a manhole is backfilled and a sufficient amount of time has elapsed for the backfill to settle, the disturbed area shall be machined to a smooth surface matching the adjacent or adjoining ground surfaces.

C. The Contractor shall grow a stand of grass by the hydroseeding method on all disturbed areas. The Contractor shall be responsible for the satisfactory growth of grass throughout the period of the 1-year guarantee.

D. The Contractor's work shall include the preparation of the topsoil and bare soil seed bed; application of fertilizer, limestone, mulching, inoculant, and temporary soil stabilizer; watering; and all other operations necessary to provide a satisfactory growth of sod at the end of the 1-year maintenance period. Areas without satisfactory sod at the end of 1 year shall be replanted until satisfactory growth is obtained and is acceptable to the Engineer.

E. All areas to be seeded shall be done by the hydraulic seeding method including all additives and amendments required. A "Reinco", "Finn", or "Bowie" type hydromulcher with adjustable nozzles and extension hoses shall be utilized. General capacity of tank should range from 500 to 2,500 gallons or as approved by the Engineer.

F. Hydraulic seeding shall be carried out in three steps. Step one shall consist of the application of lime. In step two, the seed mixture shall be mixed with the fertilizer, hydraulic mulch, and any required inoculants and applied to the seed bed. Step three shall consist of application of top dressing during the first spring or fall, whichever comes first.

G. Sowing of seed shall promptly follow after incorporation of fertilizer in a uniform manner at the rates specified for each seed species. Permanent seeding and temporary seeding shall be per the type and rates specified in Article 2.06 herein. Seed shall be broadcast as soon as possible following roughening, before surface has been sealed by rainfall.

H. Permanent Seeding: After initial fertilization of the ground and subsequent seeding, the types and application rates of lime, fertilizer, and mulch shall be as follows for permanent seeding:

1. Soft Soil

a. Mulching: Mulching shall be applied in accordance with the requirements given in Article 2.07.

b. Soil Amendments After Growth: After the required grass species have emerged and shown normal growth (usually approximately 40 days) and while the soil surface is moist, a second application of fertilizer shall be made. This second application shall be placed as a uniformly applied top dressing of 40 pounds of N, 40 pounds of P_2O_5, and 40 pounds of K_2O per acre or equivalent as approved by the Engineer. This application of fertilizer will not be required for temporary planting (Annual Ryegrass).

2. Rocky or Hardpan Areas

a. The mulching and soil amendments after growth of the seeds shall be in accordance with the requirements given for this work in soft soil.

3. Steep Slopes (2H:1V or Steeper)

a. Mulching: Mulching shall be applied in accordance with the requirements given for this work in soft soil.

b. Second Application of Fertilizer After Mulching: 1/2 of the fertilizer required for the initial fertilization of soft soil shall be applied approximately 40 calendar days after mulching.

c. Third Application of Fertilizer: A third application of fertilizer shall be made approximately 40 calendar days after the second application of fertilizer. This application shall be placed as a uniformly applied top dressing of 500 pounds of 8-8-8 fertilizer per acre or equivalent as approved by the Engineer.

4. Stubble

a. The soil amendments after growth of the seeds shall be in accordance with the requirements given for this work in soft soil.

b. Additional lime application will not be required for seeding in stubble.

c. Mulch may be applied to bare areas if requested by the Contractor and approved by the Engineer.

I. Temporary Mulching Only: At locations where the final grading should be completed within 60 calendar days, all bare ground shall be stabilized with temporary mulching at a rate of no less than 6,000 pounds per acre.

J. Temporary Seeding and Mulching

1. Seeding and Mulching: Apply at a rate of no less than 4,000 pounds per acre, either separately or concurrently with fertilizer.

2. Areas seeded with temporary seed mixtures shall be reseeded with permanent seed by the Contractor at no additional cost to the Owner as directed by the Engineer.

K. Ingredients for the mixture and steps should be dumped into a tank of water, thoroughly mixed into a homogeneous slurry, and sprayed out under a minimum of 300 to 350 pounds of pressure in suitable proportions to accommodate the type and capacity of the hydraulic machine to be used. Applications shall be evenly sprayed over the ground surface. The Contractor shall free the topsoil of stones, roots, rubbish, and other deleterious materials and dispose of same off the site. The bare soil, except existing steep embankment areas, shall be rough raked to remove stones, roots, and rubbish over 4 inches in size and other deleterious materials, and this material shall be disposed of off the site.

L. No seeding should be undertaken in windy or unfavorable weather, when the ground is too wet to rake easily, when it is in a frozen condition, or when it is too dry. Any bare spots shown in two to three weeks shall be recultivated, fertilized at half the rate, raked, seeded, and mulched again by mechanical or hand broadcast method acceptable to the Engineer.

M. A satisfactory stand of grass cover shall be defined as 80 percent coverage of the required seed species designated for establishment. There shall be no areas void of the required species larger than 4 square feet. If these requirements are not met prior to Final Completion of the Project, Contractor shall reseed the affected area(s) following the original seeding recommendations.

N. Areas that have been seeded with a temporary seed mixture shall be mowed to a height of less than 2 inches and scarified prior to seeding with the permanent seed mixture.

O. The Contractor shall provide, at his own expense, protection for all seeded areas against trespassing and damage at all times until acceptance of the Work. Slopes shall be protected from damage due to erosion, settlement, and other causes and shall be repaired promptly at the Contractor's expense.

P. The Contractor shall water newly seeded areas of the lawn and road shoulder mix once a week until the grasses have germinated sufficiently to produce a healthy turf, unless otherwise directed by the Engineer. Each watering shall provide 3 gallons per square yard. The Contractor shall furnish all necessary hoses, sprinklers, and connections.

Q. The first and second cutting of the lawn grasses only shall be done by the Contractor. All subsequent cuttings will be done by the Owner's forces in a manner specified by the Contractor.

3.06 DITCH AND SWALE EROSION PROTECTION

A. All ditches and swales indicated on the Drawings shall be lined with a rolled erosion control mat (RECM). The area to be covered shall be properly graded and hydroseeded before the RECM is installed. Installation shall be in accordance with Section 02270 – Slope Protection and Erosion Control.

3.07 MAINTENANCE

A. The Contractor shall be responsible for maintaining all seeded areas through the end of his warranty period. Maintenance shall include, but not be limited to, annual fertilization, mowing, repair of seeded areas, irrigation, and weed control. The Contractor shall provide, at his own expense, protection for all seeded areas against trespassing and damage at all times until acceptance of the Work. Slopes shall be protected from damage due to erosion, settlement, and other causes and shall be repaired promptly at the Contractor's expense.

B. Annual fertilization shall consist of an application of 500 pounds per acre of 10-10-10 commercial grade fertilizer or its equivalent and 60 pounds per acre of Nitrogen in early fall, or other analysis as may be determined by soil test. Annual fertilization shall be in addition to top dressing and shall be performed by the Contractor each fall season after planting until the Work is substantially complete.

C. Mowing shall be scheduled so as to maintain a minimum stand height of 4 inches or as directed by the Engineer. Stand height shall be allowed to reach 8 to 10 inches prior to mowing.

D. All seeded areas shall be inspected on a regular basis, and any necessary repairs or reseedings shall be made within the planting season if possible. If the stand should be over 60 percent damaged, it shall be reestablished following the original seeding recommendations.

E. Weed growth shall be maintained mechanically and/or with herbicides. When chemicals are used, the Contractor shall follow the current Alabama Agricultural Experiment Stations' weed control recommendations and shall strictly adhere to the instructions on the label of the herbicide. No herbicide shall be used without prior approval of the Engineer.

3.08 FENCE RESET AND FENCE REPLACEMENT

A. Should performance of the Work require the removal of an existing fence, the Contractor shall reset the fence in-kind to the satisfaction of the fence owner.

B. Should performance of the Work result in the damage to an existing fence, the Contractor shall replace the fence in-kind to the satisfaction of the fence owner.

C. The Contractor shall make every effort to maintain the integrity of an existing fence.

D. Removal of an existing fence must be supervised and/or approved by the Owner and/or Engineer.

3.09 CLEANUP

A. The Contractor shall remove from the site all subsoil excavated from his Work and all other debris including, but not limited to, branches, paper, and rubbish in all landscape areas. Contractor shall remove temporary barricades as the work proceeds.

B. All areas shall be kept in a neat and orderly condition at all times. Prior to Final Acceptance, the Contractor shall clean up the entire landscaped area to the satisfaction of the Engineer.

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DIVISION 32

EXTERIOR IMPROVEMENTS

SECTION 32 11 00
BASE COURSE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. T 89, Standard Method for Determining the Liquid Limit of Soils.
      b. T 90, Determining the Plastic Limit and Plasticity Index of Soils.
      c. T 96/ASTM C131, Standard Test Method for Resistance to Degradation of Small Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.
      d. T 99, Standard Methods of Test for the Moisture-Density Relations of Soils Using a 5.5 pound (2.5 kg) Rammer and a 12-inch (305 mm) Drop.
      e. T 180, Standard Methods of Test for the Moisture-Density Relations of Soils Using a 10 pound (4.54 kg) Rammer and an 18-inch (457 mm) Drop.
      f. T 191, Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method.
      g. T 238, Standard Method of Test for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

A. Completed Course: Compacted, unyielding, free from irregularities, with smooth, tight, even surface, true to grade, line, and cross-section.

B. Completed Lift: Compacted with uniform surface reasonably true to cross- section.

C. Standard Specification: The latest edition, including supplements of the Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction.

1.4 SUBMITTALS

A. Quality Control Submittals:
   1. Certified Test Results on Source Materials: Submit copies from commercial testing laboratory 20 days prior to delivery of materials to project.

2. Certified Results of In-Place Density Tests from independent testing agency.

PART 2 - PRODUCTS

2.1 BASE COURSE ROCK

A. Crushed Stone material shall conform with the requirements of the applicable sections of the ALDOT Standard Specifications and shall consist of clean, hard and durable particles or fragments, free from dirt, vegetation or objectionable materials. Two classes of crushed stone may be referred to as follows:
   1. Class I – ALDOT No. 78 Aggregate
   2. Class II – Dense Graded Aggregate (DGA)

2.2 SOURCE QUALITY CONTROL

A. Contractor: tests necessary to locate acceptable source of materials meeting specified requirements.

B. Final approval of aggregate material will be based on materials' test results on installed materials.

C. Should separation of course from fine materials occur during processing or stockpiling, immediately change methods of handling materials to correct uniformity in grading.

PART 3 - EXECUTION

3.1 PREPARATION

A. As specified in Section 31 22 13, SUBGRADE PREPARATION.

B. Obtain Engineer’s acceptance of subgrade before placement of base course rock.

C. Do not place base materials in snow or on soft, muddy, or frozen subgrade.

3.2 EQUIPMENT

A. Compaction Equipment: Adequate in design and number to provide compaction and obtain the specified density for each layer.

3.3 HAULING AND SPREADING

A. Hauling Materials:

1. Do not haul over surfacing in process of construction.
2. Loads: Of uniform capacity.
3. Measure capacity of truck to determine vehicle load and quantity.
4. Maintain consistent gradation of material delivered; loads of widely varying gradations will be cause for rejection.

B. Spreading Materials:
1. Distribute material to provide required density, depth, grade and dimensions with allowance for subsequent lifts.
2. Produce even distribution of material upon roadway without segregation.
3. Should segregation of coarse from fine materials occur during placing, immediately change methods of handling materials to correct uniformity in grading.

3.4 CONSTRUCTION OF COURSES

A. General: Complete each lift in advance of laying succeeding lift to provide required results and adequate inspection.

B. Base Course:
1. Maximum Completed Lift Thickness: 6 inches.
2. Completed Course Total Thickness: As shown.
3. Spread lift on preceding course to required cross-section.
4. Lightly blade and roll surface until thoroughly compacted.
5. Add keystone to achieve compaction and as required when aggregate does not compact readily due to lack of fines or natural cementing properties, as follows:
   a. Use base 1/4-minus crushed aggregate material as keystone.
   b. Spread evenly on top of crushed base course, using spreader boxes or chip spreaders.
   c. Roll surface until keystone is worked into interstices of crushed base course without excessive displacement. ,
   d. Continue operation until course has become thoroughly keyed, compacted, and will not creep or move under roller.
6. Blade or broom surface to maintain true line, grade, and cross-section.

3.5 ROLLING AND COMPACTION

A. Blade or otherwise work existing surface as necessary to achieve a smooth and thoroughly compacted surface.

B. Commence compaction of each layer of base after spreading operations and continue until density of 100 percent of maximum density has been achieved as determined by AASHTO T 99.

C. Commence rolling at outer edges of surfacing and continue toward center; do not roll center of road first.

D. Apply water as needed to obtain densities.

E. Place and compact each lift to the required density before succeeding lift is placed.

F. Bind up preceding course before placing leveling course. Remove floating or loose stone from surface.

G. Blade or otherwise work surfacing as necessary to maintain grade and cross- section at all times, and to keep surface smooth and thoroughly compacted.

H. Surface Defects: Remedy surface defects by loosening and rerolling entire area, including surrounding surface, until thoroughly compacted.
   1. Finished Surface: True to grade and crown before proceeding with surfacing.

3.6 SURFACE TOLERANCES

A. Finished Surface of Base Course: Within plus or minus 0.04-foot of grade shown at any individual point.

B. Overall Average: Within plus or minus 0.01-foot from crown and grade specified.

3.7 FIELD QUALITY CONTROL

A. In-Place Density Tests:
   1. Construct base course so areas shall be ready for testing.
   2. Allow reasonable length of time for testing laboratory to perform tests and obtain results during normal working hours.
   3. Show proof that areas meet specified requirements before identifying density test locations.
   4. Perform a minimum of 2 tests on completed course per 200 cubic yards of material placed in accordance with T 191, or T 238 at locations acceptable to Engineer.

B. Cleaning

   1. Remove excess material; clean stockpile areas of aggregate.

END OF SECTION

SECTION 32 12 16
ASPHALT PAVING

PART 1 GENERAL

1.01 REQUIREMENTS

A. Pave width shown on the Drawings and as required for new pavement and restoration of pavement damaged during completion of the Work detailed.

1.02 DEFINITIONS

A. Combined Aggregate: All mineral constituents of asphalt concrete mix, including mineral filler and separately sized aggregates.

B. RAP: Reclaimed asphalt pavement.

C. Standard Specifications: Alabama Department of Transportation Standard Specifications for Highway Construction, 2006 Edition.

1.03 DESIGN REQUIREMENTS

A. Prepare asphalt concrete mix design, meeting the following design criteria, tolerances, and other requirements of Section 410, of the Standard Specifications, Hot Mix Asphalt Pavement.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Independent Testing Laboratory: In accordance with ASTM E329.
2. Asphalt concrete mix formula shall be prepared by approved certified independent laboratory under the supervision of a certified asphalt technician.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Temperature: Do not apply asphalt materials or place asphalt mixes when ground temperature is lower than 10 degrees C (50 degrees F) or air temperature is lower than 4 degrees C (40 degrees F). Measure ground and air temperature in shaded areas away from heat sources or wet surfaces.

B. Moisture: Do not apply asphalt materials or place asphalt mixes when application surface is wet.

PART 2 PRODUCTS

2.01 MATERIALS

A. Tack Coat: Emulsified asphalt, conform to Section 405 of the Standard Specifications.

B. Sand (Blotter Material): Clean, dry, with 100 percent passing 4.75-millimeter (No. 4) sieve, and a maximum of 10 percent passing 75 (m (No. 200) sieve.

2.02 ASPHALT CONCRETE MIX

A. General:

1. Mix formula shall not be modified except with written approval of Engineer.
2. Source Changes:
   a. Should material source(s) change, establish new asphalt concrete mix formula before new material(s) is used.
   b. Perform check tests of properties of plant-mix bituminous materials on first day of production and as requested by Engineer to confirm that properties are in compliance with design criteria.
   c. Make adjustments in gradation or asphalt content as necessary to meet design criteria.

B. Asphalt Concrete: As specified in Section 410 of the Standard Specifications.

C. Composition: Hot-plant mix of aggregate, mineral filler if required, and paving grade asphalt cement. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that resulting mixture meets grading requirements of mix formula.

D. Aggregate: General: As specified in Section 410 of the Standard Specifications.

E. Mineral Filler: In accordance with Section 410 of the Standard Specifications.

F. Asphalt Cement: Paving Grade as specified in Section 410 of the Standard Specifications.

PART 3 EXECUTION

3.01 GENERAL

A. Traffic Control:

1. Provide as required by the State and Local Authority.
2. Plan shall met the requirements of the Federal Manual on Uniform Traffic Control Devices (MUTCD).
3. Minimize inconvenience to traffic, but keep vehicles off freshly treated or paved surfaces to avoid pickup and tracking of asphalt.

B. Driveways: Repave driveways from which pavement was removed. Leave driveways in as good or better condition than before start of construction.

3.02 LINE AND GRADE

A. Provide and maintain intermediate control of line and grade, independent of underlying base, to meet finish surface grades and minimum thickness.

B. Shoulders: Construct to line, grade, and cross-section shown.

3.03 APPLICATION EQUIPMENT

A. In accordance with Section 410 of the Standard Specifications.

3.04 PREPARATION

A. Prepare subgrade as in accordance with Section 301 of the Standard Specifications or as specified on the Drawings.

B. Existing Roadway:

1. Modify profile by grinding, milling, or overlay methods as approved, to provide meet lines and surfaces and to produce smooth riding connection to existing facility.
2. Remove existing material to a minimum depth of 1-inch.
3. Paint edges of meet line with tack coat prior to placing new pavement.

C. Thoroughly coat edges of contact surfaces (curbs, manhole frames) with emulsified asphalt or asphalt cement prior to laying new pavement. Prevent staining of adjacent surfaces.

3.05 PAVEMENT APPLICATION

A. General: Place asphalt concrete mixture on approved, prepared base in conformance with Section 410 of the Standard Specifications.

B. Tack Coat:

1. Prepare material, as specified in Section 410 of the Standard Specifications, prior to application.
2. Apply uniformly to clean, dry surfaces avoiding overlapping of applications.
3. Do not apply more tack coat than necessary for the day’s paving operation.
4. Touchup missed or lightly coated surfaces and remove excess material.
5. Application Rate: Minimum 0.05 to 0.15 gallon per square yard of surface area.

C. Pavement Mix:

1. Prior to Paving:
    a. Sweep primed surface free of dirt, dust, or other foreign matter.
    b. Patch holes in primed surface with asphalt concrete pavement mix.
    c. Blot excess prime material with sand.
2. Place asphalt concrete pavement mix in two equal lifts.
3. Compacted Lift Thickness:
    a. Minimum: Twice maximum aggregate size, but in no case less than 1 inch.
    b. Maximum: 4 inches.
4. Total Compacted Thickness: As shown.
5. Apply such that meet lines are straight and edges are vertical.
6. Collect and dispose of segregated aggregate from raking process. Do not scatter material over finished surface.
7. Joints:
    a. Offset edge of each layer a minimum of 6 inches so joints are not directly over those in underlying layer.
    b. Offset longitudinal joints in roadway pavements so longitudinal joints in wearing layer coincide with pavement centerlines and lane divider lines.
    c. Form transverse joints by cutting back on previous day's run to expose full vertical depth of layer.
8. Succeeding Lifts: Apply tack coat to pavement surface between each lift.
9. After placement of pavement, seal meet line by painting a minimum of 6 inches on each side of joint with cut-back or emulsified asphalt. Cover immediately with sand.

D. Compaction: Roll until roller marks are eliminated and minimum percent compaction as stated in the Standard Specifications.

E. Tolerances:

1. General: Conduct measurements for conformity with crown and grade immediately after initial compression. Correct variations immediately by removal or addition of materials and by continuous rolling.
2. Completed Surface or Wearing Layer Smoothness:
    a. Uniform texture, smooth, and uniform to crown and grade.
    b. Maximum Deviation: 1/8 inch from lower edge of a 12-foot straightedge, measured continuously parallel and at right angle to centerline.
    c. If surface of completed pavement deviates by more than twice specified tolerances, remove and replace wearing surface.

3. Transverse Slope Maximum Deviation: 1/4-inch in 12 feet from rate of slope shown.
4. Finished Grade:
    a. Perform field differential level survey on maximum 50-foot meter grid and along grade breaks.
    b. Maximum Deviation: 0.02 foot from grade shown.

F. Seal Coat:

1. General: Apply seal coat of paving grade or emulsified asphalt to finished surface at longitudinal and transverse joints, joints at abutting pavements, areas where asphalt concrete was placed by hand, patched surfaces, and other areas as directed by Engineer.
2. Preparation:
    a. Surfaces that are to be sealed shall be maintained free of holes, dry, and clean of dust and loose material.
    b. Seal in dry weather and when temperature is above 2 degrees C (35 degrees F).
3. Application:
    a. Fill cracks over 1/16-inch in width with asphalt-sand slurry or approved crack sealer prior to sealing.
    b. When sealing patched surfaces and joints with existing pavements, extend minimum 6 inches beyond edges of patches.

3.06 PAVEMENT OVERLAY

A. Preparation:

1. Remove fatty asphalt, grease drippings, dust, and other deleterious matter.
2. Surface Depressions: Fill with asphalt concrete mix, and thoroughly compact.
3. Damaged Areas: Remove broken or deteriorated asphalt concrete and patch as specified in Article Patching.
4. Portland Cement Concrete Joints: Remove joint filler to minimum 1/2 inch below surface.

B. Application:

1. Tack Coat: As specified in this section.
2. Place and compact asphalt concrete as specified in Article Pavement Application.
3. Place first layer to include widening of pavement and leveling of irregularities in surface of existing pavement.
4. When leveling irregular surfaces and raising low areas, the actual compacted thickness of any one lift shall not exceed 2 inches.

5. Actual compacted thickness of intermittent areas of 120 square yards or less may exceed 2 inches, but not 4 inches.
6. Final wearing layer shall be of uniform thickness, and meet grade and cross-section as shown.

3.07 PATCHING

A. Preparation:

1. Remove damaged, broken, or unsound asphalt concrete adjacent to patches. Trim to straight lines exposing smooth, sound, vertical edges.
2. Prepare patch subgrade as specified in Section 410 of the Standard Specifications.

B. Application:

1. Patch Thickness: 3 inches or thickness of adjacent asphalt concrete, whichever is greater.
2. Place asphalt concrete mix across full width of patch in layers of equal thickness.
3. Spread and grade asphalt concrete with hand tools or mechanical spreader, depending on size of area to be patched.

C. Compaction:

1. Roll patches with power rollers capable of providing compression of 200 to 300 pounds per linear inch. Use hand tampers where rolling is impractical.
2. Begin rolling top course at edges of patches, lapping adjacent asphalt surface at least 1/2 the roller width. Progress toward center of patch overlapping each preceding track by at least 1/2 width of roller.
3. Make sufficient passes over entire area to remove roller marks and to produce desired finished surface.

D. Tolerances:

1. Finished surface shall be flush with and match grade, slope, and crown of adjacent surface.
2. Tolerance: Surface smoothness shall not deviate more than plus 1/4-inch or minus 0 millimeter when straightedge is laid across patched area between edges of new pavement and surface of old surfacing.

3.08 FIELD QUALITY CONTROL

A. General: Provide services of approved certified independent testing laboratory to conduct tests.

B. Field Density Tests:

1. Perform tests from cores or sawed samples in accordance with AASHTO T230 and AASHTO T166.
2. Measure with properly operating and calibrated nuclear density gauge in accordance with ASTM D2950.
3. Maximum Density: In accordance with ASTM D2041, using sample of mix taken prior to compaction from same location as density test sample.

C. Testing Frequency:

1. Quality Control Tests:
   a. Asphalt Content, Aggregate Gradation: Once per every 500 tons of mix or once every 4 hours, whichever is greater.
   b. Mix Design Properties, Measured Maximum (Rice's) Specific Gravity: Once every 1,000 tons or once every 8 hours, whichever is greater.
2. Density Tests: Once every 500 tons of mix or once every 4 hours, whichever is greater.

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SECTION 32 13 13
PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete paving, sidewalks, curbs and gutters and aprons.

1.2 RELATED SECTIONS

A. Section 03 30 00, CAST-IN-PLACE CONCRETE.

B. Section 31 22 13, SUBGRADE PREPARATION: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.

C. Section 31 23 23, FILL AND BACKFILL.

D. Section 32 11 00, BASE COURSE.

1.3 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI):
   a. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
   b. ACI 301 – Specifications for Structural Concrete for Buildings
   c. ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
   d. ACI 305R – Hot Weather Concreting
   e. ACI 306R – Cold Weather Concreting
2. American Society for Testing and Materials (ASTM):
   a. ASTM A185 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
   b. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   c. ASTM C33 – Standard Specification for Concrete Aggregates
   d. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
   e. ASTM C94– Standard Specification for Ready Mixed Concrete
   f. ASTM C150 – Standard Specification for Portland Cement
   g. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete
   h. ASTM C309- Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
   i. ASTM C494– Standard Specification for Chemical Admixtures for Concrete

j. ASTM C685 – Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
k. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
l. ASTM D1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.4 SUBMITTALS

A. Provide as specified in Front End Specifications, Section 3, Paragraph 3.9 regarding SUBMITTAL PROCEDURES.

B. Product Data: Provide data on joint filler, admixtures, and curing compound.

C. Design Data: Indicate pavement thickness, designed concrete strength, reinforcement, and typical details.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

B. Obtain cementitious materials from same source throughout.

C. Follow recommendations of ACI 305R when concreting during hot weather.

D. Follow recommendations of ACI 306R when concreting during cold weather.

1.6 ENVIRONMENTAL REQUIRMENTS

A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Form Materials: conform to ACI 301.

B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).

1. Thickness: 1/2 inch.

2.2 REINFORCEMENT

A. Reinforcing Steel: ASTM A615 / A615M Grade 60 (420); deformed billet steel bars; unfinished finish.

B. Steel Welded Wire Reinforcement: Plain type, ASTM A185; in flat sheets; unfinished.

C. Dowels: ASTM A615 Grade 60 (420); deformed carbon steel bars; unfinished finish.

2.3 CONCRETE MATERIALS

A. Concrete Materials: As specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

2.4 ACCESSORIES

A. Curing Compound: ASTM C309, Type 1, Class A.

2.5 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations. Refer to Civil Plans and Specifications for site concrete design.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.

1. For trial mixtures method, employ independent testing agency acceptable to Owners Representative for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

D. Concrete Properties:

1. Refer to Construction Documents.

2.6 MIXING

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.

B. Transit Mixers: Comply with ASTM C94 / C94M.

PART 3 - EXECUTIONS

3.1 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.2 SUBBASE

A. Prepare subbase in accordance with the Alabama Department of Transportation (ALDOT) Standards.

3.3 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

3.4 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.5 REINFORCEMENT

A. Place reinforcement as indicated.

B. Place dowels to achieve pavement and curb alignment as detailed.

3.6 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.

C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

D. Apply surface retarder to all exposed surfaces in accordance with manufacturer's instructions.

3.7 JOINTS

A. Place control and expansion joints as indicated on drawings or as instructed by Engineer.

B. Place control and expansion joints and edge of new concrete to align with existing joints beyond.

C. Evenly space joint patterns not dimensioned on plans. Align joints with corners of masonry where shown on plans.

D. Place joint filler between new sidewalks and building or adjacent saw cut paving.

3.8 FINISHING

A. Sidewalk and Ramp Paving: Light broom, texture perpendicular to pavement direction.

B. Tool all edges and joints.

C. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.9 JOINT SEALING

A. See Section 07 92 00, JOINT SEALANTS for joint sealant requirements.

3.10 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 feet.

B. Maximum Variation From True Position: 1/4 inch.

3.11 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests.

1. Provide free access to concrete operations at project site and cooperate with appointed firm.
2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
3. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

B. Compressive Strength Tests: ASTM C39 / C39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.

1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
2. Perform one slump test for each set of test cylinders taken.

C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.12 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures and mechanical injury.

B. Do not permit pedestrian traffic over pavement until 75 percent design strength of concrete has been achieved.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A121, Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
   b. A313/A313M, Standard Specification for Stainless Steel Spring Wire.
   c. A392, Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
   d. A491, Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
   e. A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
   f. A615/A615M, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   g. A780, Standard Specification for Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings.
   h. A824, Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence.
   i. A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   j. C94/C94M, Standard Specification for Ready-Mixed Concrete.
   k. C150, Standard Specification for Portland Cement.
   l. C387, Standard Specifications for Packaged, Dry, Combined Materials for Mortar and Concrete.
   m. F552, Standard Terminology Relating to Chain Link Fencing.
   n. F567, Standard Practice for Installation of Chain-Link Fence.
   o. F626, Standard Specification for Fence Fittings.
   p. F668, Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric.
   q. F900, Standard Specification for Industrial and Commercial Swing Gates.
   r. F934, Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials.
   s. F1043, Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.

t. F1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
u. F1183, Standard Specifications for Aluminum Alloy Chain Link Fence Fabric.
v. F1184, Standard Specifications for Industrial and Commercial Horizontal Slide Gates.
w. F1379, Standard Terminology Relating to Barbed Tape.
x. F1911, Standard Practice for Installation of Barbed Tape.
y. F1916, Standard Specification for Selecting Chain Link Barrier Systems with Coated Chain Link Fence Fabric and Round Posts for Detention Applications.

2. Institute of Electrical and Electronic Engineers (IEEE), Inc.: C2, National Electrical Safety Code.
3. National Electrical Manufacturers Association (NEMA): 250, Enclosures for Electrical Equipment (1,000 volts max.).

1.02 DEFINITIONS

A. Terms as defined in ASTM F552.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

1.04 SCHEDULING AND SEQUENCING

A. Complete necessary Site preparation and grading before installing chain link fence and gates.

B. Interruption of Existing Utility Service: Notify owner of utility 72 hours prior to interruption of utility services. Do not proceed with interruption of utility service without written permission from utility owner.

PART 2 PRODUCTS

2.01 GENERAL

A. Match style, finish, and color of each fence component with that of other fence components.

2.02 CHAIN LINK FENCE FABRIC

A. PVC-coated or Polymer-coated galvanized fabric conforming to ASTM F668, Class 1 or Class 2a over metallic-coated steel wire.

1. Color: Black, complying with ASTM F934.

B. Height: 84 inches, unless otherwise shown.

C. Core Wire Gauge: No. 9.

D. Pattern: 2-inch diamond-mesh.

E. Diamond Count: Manufacturer's standard and consistent for fabric furnished of same height.

F. Loops of Knuckled Selvages: Closed or nearly closed with space not exceeding diameter of wire.

G. Wires of Twisted Selvages:

1. Twisted in a closed helix three full turns.
2. Cut at an angle to provide sharp barbs that extend minimum 1/4 inch beyond twist.

2.03 POSTS

A. General:

1. Strength and Stiffness Requirements: ASTM F1043, heavy industrial fence, except as modified in this section.
2. Round Steel Pipe, Schedule 40: ASTM F1083.
3. Roll-Formed Steel Shapes: Roll-formed from ASTM A1011/A1011M, Grade 45, High-Strength Low-Alloy steel.
4. Lengths: Manufacturer's standard with allowance for minimum embedment below finished grade of 34 inches.
5. Protective Coatings:
   a. Zinc with Polymer Film Coating: ASTM F1043, Type B external and internal coating.
6. Color Coating: ASTM F1043, minimum 10 mils thickness over zinc coating to match color of chain link fabric.

B. Line Posts:

1. Round Steel Pipe:
   a. Outside Diameter: 2.375 inches.
   b. Weight: 3.65 pounds per foot.

C. End, Corner, Angle, and Pull Posts:

1. Round Steel Pipe:
   a. Outside Diameter: 2.875 inches.
   b. Weight: 5.79 pounds per foot.

D. Posts for Removable Fence Panels: As specified for end, corner, angle, and pull posts.

E. Posts for Swing Gates 8 Feet High and Under:

1. ASTM F900.
2. Round Steel Pipe:
    a. Outside Diameter: 4 inches.
    b. Weight: 6.56 pounds per foot.

F. Posts for Swing Gates Over 8 Feet High: As recommended by fence manufacturer.

G. Posts for Horizontal Sliding Gates:

1. ASTM F1184, Type II, Class 2.
2. Round Steel Pipe:
    a. Outside Diameter: 4 inches.
    b. Weight: 6.56 pounds per foot.
3. Guide posts for Class 1 horizontal-slide gates, equal gate post height, one size smaller, but weight is not less than 3.11 pounds per foot, installed adjacent to gate post to permit gate to slide in space between.

2.04 TOP AND BRACE RAILS

A. Galvanized Round Steel Pipe:

1. ASTM F1083.
2. Outside Diameter: 1.66 inches.
3. Weight: 2.27 pounds per foot.

B. Galvanized Roll-Formed Steel C Shapes:

1. Roll formed from ASTM A1011/A1011M, Grade 45.
2. Outside Dimensions: 1.625 inches by 1.25 inches.
3. Weight: 1.40 pounds per foot.

C. Protective Coatings: As specified for posts.

D. Strength and Stiffness Requirements: ASTM F1043, top rail, heavy industrial fence.

2.05 FENCE FITTINGS

A. General: In conformance with ASTM F626, except as modified by this article.

B. Post and Line Caps: Designed to accommodate passage of top rail through cap, where top rail required.

C. Tension and Brace Bands: No exceptions to ASTM F626.

D. Tension Bars:

1. One-piece vinyl-clad.
2. Length not less than 2 inches shorter than full height of chain link fabric.
3. Provide one bar for each gate and end post, and two for each corner and pull post.

E. Truss Rod Assembly: 3/8-inch diameter, steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

F. Tie Wires, Clips, and Fasteners: According to ASTM F626.

G. Barbed Wire Supporting Arms: Pressed steel or cast iron with clips, slots, or other means for attaching strands of barbed wire integral with post cap for each post, with single 45-degree arms for supporting three strands of barbed wire. Arms shall withstand 250 pounds of downward pull at outermost ends of the arms without failure.

2.06 TENSION WIRE

A. Zinc-coated steel marcelled tension wire conforming to ASTM A824, Type I.

2.07 BARBED WIRE

A. Zinc-Coated Barbed Wire: ASTM A121, Chain Link Fence Grade:

B. Aluminum-Coated Steel Barbed Wire: ASTM A121, Type II.

1. Line Wire: Two strands of No. 12-1/2 gauge.
2. Barbs:
   a. Number of Points: Four.
   b. Length: 3/8-inch minimum.
   c. Shape: Round.
   d. Diameter: No. 14-gauge.
   e. Spacing: 5 inches.

2.08 BARBED TAPE

A. Series 430 stainless steel hardened to Rockwell (30N) 35-40 minimum; 0.025-inch thick by 1-inch wide before fabrication, die stamped to produce

clusters of four pointed needle-sharp barbs at 4 inches on center, minimum 1.2 inches long, offset in alternate directions 0.15 to 0.45 inch.

B. Permanently cold clench stainless steel strip to minimum 230 degrees F around core wire.

C. Core wire: 0.098-inch diameter, high-tensile-strength stainless steel complying with ASTM A313/A313M.

D. Stainless steel strip between barb clusters shall be 1/4-inch wide minimum after cold clenching to create a flange extending out from the wire, tapering off adjacent to the barb cluster to allow maximum barb penetration.

E. Fabrication: Continuous coils of barbed tape as defined in ASTM F1379 for the following characteristics:

1. Configuration: Double coil.
2. Style: Concertina pattern.
3. Coil Diameters: 24-inch inner coil and 30-inch outer coil, plus or minus 2 inches, when coil compressed.
4. Coil Loop Spacing: 12 inches.

F. Clips: Stainless steel, 0.065-inch thick by 0.375-inch wide; capable of withstanding a minimum pull load of 200 pounds for a minimum of 30 seconds without separation, or other damage.

G. Tie Wires: Stainless steel, 0.065-inch diameter.

2.09 GATES

A. General:

1. Gate Operation: Opened and closed easily by one person.
2. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F1043 and ASTM F1083 for materials and protective coatings.
3. Frames and Bracing: Fabricate members from round galvanized steel tubing with outside dimension and weight according to ASTM F900.
4. Gate leaves more than 8-feet wide shall have intermediate tubular members and diagonal truss rods to provide rigid construction, free from sag or twist.
5. Gate Fabric Height: Same as for adjacent fence height.
6. Welded Steel Joints: Paint with zinc-based paint.
7. Chain Link Fabric: Attached securely to gate frame at intervals not exceeding 15 inches.
8. Gate Posts and Frame Members: Extend gateposts and frame end members above top of chain-link fabric at both ends of gate frame to attach barbed wire assemblies.

9. Latches: Arranged for padlocking so padlock will be accessible from both sides of gate.

B. Swing Gates: Comply with ASTM F900 for single and or double swing gate types.

1. Leaf Width: As shown.
2. Hinges: Offset type, malleable iron.
   a. Furnished with large bearing surfaces for clamping in position.
   b. Designed to swing either 180 degrees outward, 180 degrees inward, or 90 degrees in or out, as shown, and not twist or turn under action of gate.
3. Latches: Plunger bar arranged to engage stop, except single gates of openings less than 10 feet wide may each have forked latch.
4. Gate Stops: Mushroom type or flush plate with anchors, suitable for setting in concrete.
5. Locking Device and Padlock Eyes: Integral part of latch, requiring one padlock for locking both leaves of double gate.
6. Hold-Open Keepers: Designed to automatically engage gate leaf and hold it in open position until manually released.

C. Cantilever and Overhead Horizontal Sliding Gates:

1. Comply with ASTM F1184 for slide gate types I roller assemblies.
2. Overhead Track Assembly: Manufacturer's standard track, with overhead framing supports, bracing, and accessories, designed to support size, weight, width, operation, and design of gate and roller assemblies.
3. Roller Guards: As required per ASTM F1184 for Type II, Class 1 gate.
4. Hangers, roller assemblies, and stops fabricated from galvanized malleable iron.

2.10 PRIVACY SLATS

A. Material: Polyethylene tubular slats, not less than 0.023-inch thick, manufactured for chain link fences from virgin polyethylene containing UV inhibitor, sized to fit mesh specified for direction indicated, with vandal-resistant fasteners and lock strips.

B. Color: Black unless otherwise directed by the ESD.

C. Fabric Selvage: Knuckled.

D. Hardware: Galvanized.

2.11 CONCRETE

A. Provide as specified in Section 03 30 00, Cast-in-Place Concrete.

2.12 FENCE GROUNDING

A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1-inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel.

PART 3 EXECUTION

3.01 GENERAL

A. Install chain link fences and gates in accordance with ASTM F567, except as modified in this section, and in accordance with fence manufacturer's recommendations, as approved by Engineer. Erect fencing in straight lines between angle points.

B. Provide necessary hardware for a complete fence and gate installation.

C. Any damage to galvanized surfaces, including welding, shall be repaired with paint containing zinc dust in accordance with ASTM A780.

D. Drainage Crossings: Where the chain-link fence must cross drainage ditches or swales, the main fence shall be carried across a ditch or swale with additional fence added below.

1. Frames and Bracing: The fence added below shall be fabricated with galvanized round steel pipe conforming to the requirements for top and brace rails.
2. The construction of the frame shall be welded or assembled with corner fittings. The frame shall be rigid and to the extent necessary to maintain a 2-inch clearance between bottom of the frame and finish grade. If necessary to maintain rigidity, attach to the frame a series of 3/8-inch diameter galvanized steel pipe stakes that are embedded a minimum of 2 feet to the sides and bottom of the ditch.

3. Attach chain link fabric securely to frame at intervals not exceeding 12 inches.

3.02 PREPARATION

A. Clear area on either side of fence to the extent as required. Eliminate ground surface irregularities along fence line to the extent necessary to maintain a 2-inch clearance between bottom of fabric and finish grade.

B. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

C. Coat portion of galvanized or aluminum-coated steel posts that will be embedded in concrete with an approved system. Extend coating 1 inch above top of concrete.

3.03 POST SETTING

A. Drill or hand-excavate holes for posts to diameters and spacing indicated, in firm, undisturbed soil. Driven posts are not acceptable. Postholes shall be clear of loose materials. Waste materials from postholes shall be removed from Site or regraded into slopes on Site.

B. Posthole Depth:

1. Minimum 3 feet below finished grade.
2. 2 inches deeper than post embedment depth below finish grade.

C. Set posts with minimum embedment below finished grade of 34 inches and with top rail at proper height above finished grade. Verify posts are set plumb, aligned, and at correct height and spacing. Brace posts, as necessary, to maintain correct position and plumbness until concrete sets.

D. Backfill postholes with concrete to 2 inches above finished grade. Vibrate or tamp concrete for consolidation. Protect above ground portion of posts from concrete splatter.

E. Before concrete sets, crown and finish top of concrete to readily shed water.

F. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

G. Line Posts: Space line posts uniformly at 10 feet on centers between terminal end, corner, and gate posts.

3.04 POST BRACING

A. Install according to ASTM F567, maintaining plumb position, and alignment of fencing. Install braces at gate, end, pull, and corner posts diagonally to adjacent line posts to ensure stability. Install braces on both sides of corner and pull posts.

1. Locate horizontal braces at mid-height of fabric or higher, on fences with top rail, and 2/3-fabric height on fences without top rail. Install so posts are plumb when diagonal truss rod assembly is under proper tension.

3.05 TOP RAILS

A. Install according to ASTM F567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps and terminating into rail end attached to posts or posts caps fabricated to receive rail at terminal posts. Install top rail sleeves with springs at 105 feet maximum spacing to permit expansion in rail.

3.06 BARBED WIRE SUPPORTING ARMS

A. Barbed wire supporting arms shall be installed as indicated and as recommended by manufacturer. Bolt or rivet supporting arm to top of post in a manner to prevent easy removal with hand tools. Angle single arms to outside of fence.

3.07 TENSION WIRE

A. Install according to ASTM F567 and ASTM F1916, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with tie wires at a maximum spacing of 24 inches on center.

B. Install tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

3.08 CHAIN LINK FABRIC

A. Do not install fabric until concrete has cured minimum 7 days.

B. Install fabric with twisted and barbed selvage at top.

C. Apply fabric to outside of enclosing framework. Pull fabric taut to provide a smooth and uniform appearance free from sag, without permanently distorting fabric diamond or reducing fabric height. Tie fabric to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

D. Splicing shall be accomplished according to ASTM F1916 by weaving a single picket into the ends of the rolls to be joined.

E. Leave 2 inches between finish grade or surface and bottom selvage, unless otherwise indicated.

F. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches on center.

G. Tie Wires: Fasten ties to wrap a full 360 degrees around rail or post and a minimum of one complete diamond of fabric. Twist ends of tie wire three full twists, and cut off protruding ends to preclude untwisting by hand.

1. Maximum Spacing: Tie fabric to line posts at 12 inches on center and to brace and top rails at 24 inches on center.

3.09 BARBED WIRE

A. Install barbed wire uniformly in configurations of three strands of barbed wire on supporting arms. Pull wire taut and install securely to supporting arms and secure to end terminal post or terminal arms.

3.10 GATES

A. Install gates according to manufacturer's written instructions, level, plumb and secure for full opening without interference. Attach fabric and hardware to gate using tamper-resistant or concealed means. Adjust hardware for smooth operation and lubricate where necessary so gates operate satisfactorily from open or closed position.

B. Set gate stops in concrete to engage center drop rod or plunger bar.

3.11 ELECTRICAL GROUNDING

A. Ground fences at a maximum interval of 1,000 feet in accordance with applicable requirements of IEEE C2, National Electrical Safety Code.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. Grounding Method: At each grounding location, drive a grounding rod vertically until top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

3.12 FIELD QUALITY CONTROL

A. Post and Fabric Testing: Test fabric tension and line post rigidity according to ASTM F1916.

B. Gate Tests:

1. Prior to acceptance of installed gates, demonstrate proper operation of gates under each possible open and close condition specified.
2. Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range.
3. Confirm that latches and locks engage accurately and securely without forcing and binding.

3.13 CLEANUP

A. Remove excess fencing materials and other debris from Site.

END OF SECTION

DIVISION 33

UTILITIES

SECTION 33 01 30
SANITARY SEWER TELEVISION INSPECTION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Work covered by this section includes furnishing all labor, competent certified technicians, equipment, tools, accessories, and materials required to clean and inspect the designated sanitary sewer lines specified.

B. Closed-circuit television (CCTV) inspection of sanitary sewers shall include the following:

1. CCTV inspection of all lines proposed for television inspection using the National Association of Sewer Service Companies (NASSCO) industry standard Pipeline Assessment and Certification Program (PACP) forms and coding.
2. CCTV inspection of line segments specified for chemical root removal shall be performed to confirm cleaning and location of service connections.

C. Digital videos, data, and photos shall be delivered to the Engineer on suitable digital media, which shall become property of the Owner. Data files shall be formatted to facilitate upload into a NASSCO PACP exchange database. Files shall be named in accordance with required standards, which will allow video files to be directly linked to pipe assets.

1.02 QUALITY ASSURANCE

A. Qualifications:

1. Contractor: Successfully performed work on at least three other projects within the last five years with at least 500,000 linear feet of CCTV experience in NASSCO PACP format.
2. CCTV Operator: Successfully performed work on at least three other projects within the last five years with at least 250,000 linear feet of CCTV experience in NASSCO PACP format. For private development, 250,000 lf experience does not apply.
3. Crew Chief: Minimum of 5 years' experience on projects similar to this Project and experienced using proposed equipment for this Project.

1.03 NOTIFICATIONS

A. Contractor's notification of Owner:

1. A minimum of five days prior to the anticipated commencement of inspections in any one area and 24 hours in advance of actual start.
2. When an obstruction that is restricting flow in the sewer pipelines is discovered.
3. If the depth of flow in a pipeline exceeds 33 percent of pipe diameter.
4. If the conditions for CCTV inspection are found to be unsafe or impractical.
5. If the pipe configuration in the field is different than shown on maps. The notification shall include a diagram clearly indicating the location of structures in relation to immediately adjacent structures.
6. A list of manholes that are buried or cannot be found.
7. Each week, Contractor shall send an email to the Owner's designated contact that lists the location(s) of work, the pipe segments and manholes that will be accessed each day, and the fire hydrants that will be utilized for a water source.

B. Contractor's notification of the public:

1. Between 24 hours and 48 hours prior to the inspection of any line segment, Contractor shall distribute door-to-door an Owner-approved door hanger describing the work to be performed to notify every residence and business that may be affected. Door hangers shall be double-sided with the notification information in the English language on one side and in the Spanish language on the reverse side.
2. Contractor notification does not apply for private developments.

PART 2 PRODUCTS

2.01 TELEVISION INSPECTION AND CLEANING EQUIPMENT

A. Contractor shall provide a mobile vehicle with video monitoring equipment specifically compatible with the camera equipment being used. The vehicle shall be large enough to accommodate at least three people at any time for viewing of the monitor. Owner and Engineer shall have unrestricted access to observe the television screen and all other operations at all times.

B. The television camera used for the inspection shall be specifically designed and constructed for such inspection. Adjustable light source to allow an even distribution of lighting for the camera shall be suitable to allow a clear color picture of the entire periphery of the pipe. The camera shall be capable of panning 360 degrees and tilting 270 degrees to facilitate the inspection of all laterals and defects, with optimum picture quality provided by focus and iris adjustment. The camera, television monitor, and other components of the video system shall be capable of producing a minimum 600-line resolution picture. Backup camera shall be available on the Project Site. The camera shall be operative in 100 percent humidity conditions and in a hazardous and corrosive environment. The camera shall be capable of zooming at least 10:1 for looking further down the pipe or up into the laterals.

C. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of Engineer and/or Owner.

D. The television inspection equipment shall have an accurate footage counter that shall display on the monitor the exact distance of the camera from the centerline of the starting manhole.

PART 3 EXECUTION

3.01 PRE-INSPECTION VIDEO

A. Prior to cleaning, Contractor shall use the CCTV equipment to document the existing debris accumulated in each line proposed for television inspection. Contractor is not required to complete the standard NASSCO PACP forms using the standard NASSCO PACP coding during filming of the pre-inspection videos since the purpose of these videos is to document the amount of pre-cleaning debris. Maximum speed of camera during filming of pre-inspection video shall be 120 feet per minute (2 feet per second). When debris is spotted during filming of the pre-inspection video, Contractor shall slow camera speed to a maximum of 30 feet per minute (0.5 feet per second), or a slower speed if required, to adequately identify the type of debris in the line and quantify its approximate volume.

1. During filming of the pre-inspection video in each line, Contractor shall also confirm the diameter of the sanitary sewer being filmed. Prior to beginning the work, Engineer will provide the Contractor with a Microsoft® Excel spreadsheet that lists each of the sanitary sewers proposed for television inspection. The spreadsheet will include the sewer Asset ID, Diameter (in inches), Upstream Manhole Asset ID (i.e. USMH_AssetID), and Downstream Manhole Asset ID (i.e. DSMH_AssetID) for each sanitary sewer to be inspected. Contractor shall add another column to the spreadsheet titled “Actual Diameter (inches)” and shall list the

actual diameter of each sewer as confirmed by the Contractor during filming of the pre-inspection video. Contractor shall pay special attention to confirming the actual diameter of the sanitary sewers in the spreadsheet that are listed as having an "Unknown" Diameter.

2. Contractor shall submit pre-inspection videos to Engineer for documentation purposes.

3.02 PREPARATION

A. Prior to the inspection, Contractor shall use CCTV or other means to identify any significant blockages. If the upstream manhole if full of water due to a blockage, a reverse setup shall be done to locate the blockage if possible. After the blockage is removed, the CCTV inspection shall be performed. The defect code for the blockage shall be correctly entered with a note that the blockage was removed prior to continuing the inspection.

B. The Contractor shall conduct a single-pass light cleaning in accordance with Section 33 01 33, Sewer Line Cleaning to remove loose debris or other minor obstructions prior to CCTV inspection. The camera shall then be inserted for inspection. No other cleaning shall be conducted prior to CCTV unless a blockage that will clearly block the camera is identified.

C. Contractor shall, in the presence of Owner's and/or Engineer's inspector, calibrate the camera footage every week with an aboveground tape measure and simultaneous CCTV footage counter.

D. Contractor shall <u>not</u> float the camera unless permitted by the Owner or his designated representative.

3.03 TELEVISION INSPECTION

A. Perform all CCTV using personnel who are trained and certified (current standing) in the use of PACP compliant software.

B. Move the camera through the line in either direction at a rate less than or equal to 30 feet per minute, stopping when necessary to permit proper documentation of the condition of the sewer line section. Digital video shall be captured at a minimum video bit rate of 4,000 kbps. In no case shall the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line.

C. When manually-operated winches are used to pull the television camera through the line, use telephones or other suitable means of communication set up between the two manholes of the section being inspected to ensure good communications between members of the crew.

D. Obstructions that cause a stuck camera shall be the responsibility of the Contractor, and the retrieval of equipment or cameras shall be the responsibility of the Contractor and shall be performed at the Contractor's expense.

E. Adjust the camera height such that the camera lens is always centered in the pipe being televised.

F. Provide a lighting system adequate for good quality pictures. A reflector in front of the camera may be required to enhance lighting in black pipe.

3.04 PASSAGE OF TV CAMERA

A. It is the intent of the scope of Work to inspect the full length of sewer between each manhole, but there may be occasions during the CCTV inspection of a sewer line section when the camera will be unable to pass an obstruction even though flow is continuing. If, during the inspection operation, the television camera will not pass through the entire manhole section, Contractor shall setup the CCTV equipment so that the inspection can be performed from the opposite manhole.

B. CCTV videos shall be submitted in one continuous video section from manhole to the immediately adjacent manhole and not in multiple files, unless specifically approved by Engineer. If a reverse setup is conducted, then two separate video files are allowable; the two separate files shall have the same filename but with an "_1", "_2", etc. at the end of the filename, or as otherwise directed by the Owner, so that it is clear there are multiple files and videos for the same pipe segment.

C. Contractor can televise multiple upstream and/or downstream sewer segments from a single manhole setup location as long as each video of sewer section from one manhole to the immediately adjacent manhole is submitted as a separate file.

D. The television camera shall travel through the lines using its own power. The pictures taken of the entire inside periphery of the pipe shall be clear and visible. Picture quality and definition shall be to the satisfaction of Engineer.

E. Stop the camera at all service laterals and pan at such an angle that an internal view of the service lateral is available to determine if the lateral is active, dead, or plugged. Where other pipe deficiencies are noted, stop the camera to observe the condition, record information, and take photographs. Photograph any service lateral or deficiency observed in the sewer line and describe it on the photograph.

F. If the CCTV inspection identifies any defect which results in a blockage of 5 percent or more, the entire pipe shall be thoroughly cleaned in accordance with Section 33 01 33, Sewer Line Cleaning until at least a 95 percent clear cross-sectional area is attained.

3.05 SEWER FLOW CONTROL

A. If an existing line is being inspected as part of the work, the flow in the sewer line section(s) undergoing inspection shall be suitably controlled. The depth of wastewater flow shall not exceed the following:

1. 4-inch to 10-inch Pipe: 20 percent of pipe diameter.
2. 12-inch to 18-inch Pipe: 25 percent of pipe diameter.
3. Over 24-inch: 30 percent of pipe diameter.

B. When the depth of flow in the section(s) being inspected is above the maximum allowable for the television inspection, the flow shall be reduced to allowable levels by performing the inspection during periods of minimum flow, with diversion pumping, or by pulling the camera with swab or a high velocity jet nozzle, as approved by the Engineer.

C. When flow in a sewer line is plugged, blocked, or bypassed, sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. Further, precautions must be taken to insure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved.

3.06 SEWER INSPECTION SOFTWARE

A. All sewer inspection shall use PACP compliant Software. Software shall be capable of providing complete survey reports in compliance with current version of NASSCO PACP.

B. The PACP compliant Software and the submitted database shall be fully compliant with PACP. The submittal/output must be standard PACP exchange Access database.

C. The PACP defect and construction codes shall be pre-programmed in the PACP compliant software and shall be grouped by PACP Groups.

D. The PACP compliant software shall be capable of customization with the ability to modify or add to the pipeline condition and group them for ease of use.

E. The footage reading from the camera equipment shall be automatically entered into the Survey Log and shall directly correspond to the noted defect location throughout the pipe graphical and tabular reports generated.

F. The PACP compliant inspection and reporting software program shall be menu-driven and shall have a complete on-screen help file.

G. All NASSCO PACP mandatory fields shall be entered, and any additional fields requested by the Owner or his representative shall also be entered. This pipe segment information shall be entered prior to the actual survey.

H. The PACP Compliant software shall maintain a database of underground pipe and manhole assets. The database shall have a structure similar to the one referencing pipe usage (i.e., sanitary, storm, drainage, etc.) sections (i.e., projects, areas, or quadrants). Surveys shall include a method of pipe segment numbering and a chronological survey set-up numbering system. The PACP compliant software shall also have the capability to import and export survey results in the current NASSCO PACP Access exchange format.

3.07 SEWER INSPECTION REPORTS

A. Summary reports shall indicate individual survey results in tabular form and shall provide a sortable list of surveys based on a user-defined description field. It shall include starting and ending manhole numbers, depths, pipe material, total survey length, and pipe diameter. All reports and/or submittals shall adhere to NASSCO PACP Standards.

B. Contractor shall submit, in electronic format, digital videos, photos, and evaluation reports to Engineer.

C. If digital videos are of such poor quality that Engineer is unable to evaluate the condition of the sanitary sewer main, locate the sewer service connections, or verify the cleaning, Contractor shall be required to re-televise the sanitary sewer and provide new digital videos of good quality, at no additional cost to Owner.

D. All digital videos shall become the property of Owner.

E. All software and reports shall be in accordance with latest PACP standards.

F. Data to be provided weekly to Engineer shall either be recorded on a portable external hard drive or directly copied to Engineer's portable external hard drive. Each hard drive shall be filled with as much data as practical to minimize the number of hard drives submitted. Sections of a single segment of sewer main shall not be recorded to more than one hard drive. Video footage of recorded segments shall be grouped by area and shall be submitted in sequential order relating to the area mapping designation. The footage counter reading from the camera equipment shall appear on all videos. Throughout the duration of the Project, should Engineer discover inaccuracies in any of the videos, Contractor shall re-inspect those segments at no additional cost to the Engineer or Owner. The Engineer will require a 30-day period to perform a quality review of sewer inspection data/videos after data/videos have been received from the Contractor.

G. Contractor shall provide to Engineer CCTV inspection data via external hard drive on a weekly basis and on a monthly basis. Data shall be recorded and provided in a current version of PACP exchange format. The data shall specifically include video indexing for all observations. Prior to beginning the CCTV inspection work, Contractor shall submit a sample deliverable of CCTV inspection data for a single length of sewer pipeline obtained from a past CCTV inspection project performed by the Contractor; Contractor shall not proceed with the CCTV inspection work until this sample deliverable has been submitted to the Engineer for review and the Engineer has subsequently approved its format and contents. Data to be submitted with sample deliverable and weekly/monthly submittals shall include:

1. Database file.
2. Still photos as .jpg files.
3. Videos for each pipe segment in MPEG-1 format.
4. A summary report for each pipe segment as a .pdf file.
5. Files shall be named in accordance with the Owner's requirements, which Contractor shall obtain in writing prior to commencing any Work.

H. The camera equipment/software shall be capable of producing digitized images of all sewer line defects, manhole defects, and sewer line service connections in .jpg format. Contractor shall take digital still images of each defect, construction feature, and service connection to clearly depict it. More images may be necessary depending upon the condition of the pipe. A minimum of three digital photos shall be taken in each manhole to illustrate the condition of the manhole. The digital photographs (.jpgs) shall be at least 50 kilobytes in size. The screen capture shall include an onscreen display with date, reach number, footage, and type of defect/PACP code. The photographs shall become the property of the Owner.

I. Upon approval by the Engineer of all, or portions of, the data delivered via the portable external hard drives, the approved CCTV data shall be delivered to Engineer on portable external hard drives. Each portable external hard drive shall be labeled to clearly indicate the date of the inspection, the designated segment(s) of sewer mains(s) contained on the portable external hard drive, the name of the Project, the Project CIP number, Contractor name, and the index number of the portable external hard drive. The portable external hard drives shall contain separate digital files for each manhole-to-manhole section. The index number shall indicate the sequential number of the portable external hard drive followed by the mini-basin number.

J. The database shall be comprehensive for the entire Project, and additional data shall be added to the database each week. Each manhole has been given a unique manhole identification (Asset ID) per the Owner's guidelines, and the name of each database file shall be either that unique upstream Asset ID followed by the unique downstream Asset ID or as otherwise directed by the Owner. If an unnamed manhole is found, either the letter "A" will be added to the end of the upstream manhole's Asset ID to form a new Asset ID for the unnamed manhole or it will be named as otherwise directed by the Owner. The data/video files shall then be renamed to include the new Asset ID, and a new CCTV inspection shall be started from the new Asset ID. If more than one unnamed manhole is found between two named manholes, subsequent new manhole IDs shall either be formed using the letters "B", "C", etc. or as otherwise directed by the Owner.

K. There may be situations that require Contractor to televise an individual pipe segment from more than one direction (i.e. the camera is only able to televise 75 percent of the segment heading downstream, and the remaining 25 percent must be televised heading upstream). The name of additional database files, etc. produced in these circumstances shall be either that unique upstream Asset ID followed by the unique downstream Asset ID followed by "_1", "_2", etc. or as otherwise directed by the Owner.

1. Examples: Initial file name: 0015S0001-0015S0002.
2. Additional file name(s): 0015S0001-0015S0002_1.
3. If unnamed manhole(s) is (are) found, the procedure previously described shall also apply.

L. The name of each digital still image shall be based on the video/data file name of the sewer reach in which the image was taken. The name shall be either recorded as the video/data file name, followed by the PACP code for the item pictured, followed by the footage at which the item was found (i.e. (File Name) (PACP Code)@(Footage).jpg) or as otherwise directed by the Owner.

1. Examples: 0015S0001_0015S0002 HSV@37_2.jpg 0015S0001_0015S0002_1 MCU@113_7.jpg.

M. Contractor shall provide a typewritten summary that lists the contents of each portable external hard drive. The inspection logs shall be submitted on portable external hard drive in Adobe .pdf format with the pipe ID included in the filename, such as 0015S0001_0015S0002.pdf, and shall include color still photos (.jpg format) of significant features noted during the television inspection.

N. At the end of the Project, Contractor shall provide a digital and written summary listing of all videos provided under this Project. Digital version shall be developed and submitted in current version of either Microsoft® Excel or Microsoft® Access software.

END OF SECTION

SECTION 33 01 33
SEWER LINE CLEANING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This section details cleaning requirements for both new and existing service lines, main sewers and manholes.

B. Cleaning shall include the proper high pressure water jetting, rodding, bucketing, brushing, and flushing of service lines, main sewers and manholes prior to inspection by closed-circuit television (CCTV).

C. The goal of the cleaning is to remove all debris, roots, intruding services, deposits, and other blockages to a minimum of 95 percent open area.

1. On all service lines, main sewers and manholes, Contractor shall perform cleaning work to an acceptable level as necessary to allow a thorough using CCTV inspection.
2. Contractor shall record and code impactful operation and maintenance (O&M) defects prior to cleaning and removal. Removal of such defects via cleaning either during or after inspection shall be recorded.
3. An initial single-pass only jetter cleaning shall be conducted prior to CCTV to remove very loose debris, minor obstructions, etc. If the pipe condition is such that cleaning may cause a potential collapse, then the pipe shall be televised without attempting to clean it to the 95 percent condition, pending approval the Owner/Owner's Representative.

D. Cleaning may involve preparatory or light sewer cleaning (small amounts of debris and/or very light root growth existing within the sewer line) or heavy sewer cleaning (large amounts of debris, grease, large size stones and bricks, and/or heavy root growth existing within the sewer line). Cleaning shall dislodge, transport, and remove all sludge, mud, sand, gravel, rocks, bricks, grease, roots, sticks, and all other debris from the interior of the sewer pipe and manholes.

PART 2 PRODUCTS

2.01 MATERIALS

A. Hydraulically-propelled Sewer Cleaning Equipment:

1. Contractor shall take precautions against flooding prior to using sewer cleaning balls or other such equipment that cannot be instantly collapsed.

B. High Velocity Hydro-Cleaning Equipment shall have the following:

1. Sufficient high pressure hose to clean the required segment(s).
2. Two or more high velocity nozzles capable of producing a scouring action from 15 to 45 degrees in all size lines to be cleaned.
3. A high velocity gun for washing and scouring manhole walls and floor.
4. Capability of producing flows from a fine spray to a long distance solid stream.
5. A water tank, auxiliary engines and pumps, and a hydraulically driven hose reel.
6. Equipment operating controls located aboveground.

C. Mechanical cleaning equipment shall be either power buckets or power rodders by the Flexible Tool Division of Rockwell Manufacturing Co. or equal. Mechanical equipment shall only be utilized with prior approval of the Owner/Owner's Representative and after structural condition of the pipe has been verified and Contractor has indicated that jetting will not be sufficient to perform the cleaning and mechanical cleaning will not further damage the pipe.

1. Power bucket machines shall:
   a. Be furnished with buckets in pairs and with sufficient dragging power to efficiently perform the Work.
   b. Either use V-belts for power transmission or have an overload device. Direct drive machines will not be permitted.
   c. Be equipped with a take-up drum and a minimum of 500 feet of cable.
2. Power rodding machines shall:
   a. Be either sectional or continuous.
   b. Hold a minimum of 750 feet of rod.
   c. Have rods composed of treated steel.
   d. Be fully-enclosed and have an automatic safety throw out clutch.

PART 3 EXECUTION

3.01 PERFORMANCE

A. Cleaning Precautions: During sewer cleaning operations, satisfactory precautions shall be taken by the Contractor in the use of cleaning equipment. When hydraulically-propelled cleaning tools, which depend upon water pressure to provide their cleaning force, or tools which retard the flow in the service line or main sewer are used, precautions shall be taken by the Contractor to ensure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer being cleaned. Whenever possible, the Contractor shall utilize the flow of sewage in the sewer line to provide the necessary pressure for hydraulic cleaning devices. When additional water from fire hydrants is necessary to avoid delay

in normal work procedures, the water shall be conserved and not unnecessarily used. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant.

B. Sewer Cleaning: The designated shall be cleaned using hydraulically-propelled, high velocity jet, or mechanically-powered equipment. Selection of the equipment used shall be based on the conditions of the sewer lines at the time the work commences. The equipment and methods selected shall be satisfactory to the Owner/Owner's Representative. The equipment, as properly selected by the Contractor, shall be capable of removing dirt, grease, rocks, sand, and other deleterious materials and obstructions from the lines and manholes. If cleaning of an entire section of sewer cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning shall be attempted again. If successful cleaning cannot be subsequently performed from the other manhole or if the equipment fails to traverse the entire sewer section, it will be assumed that a major blockage exists and the cleaning effort shall be repeated with other types of equipment.

C. Contractor shall protect existing service lines, main sewers and manholes from damage caused by improper use of cleaning equipment.

D. Removal of Materials: Contractor shall provide appropriate screening to prevent passage of materials into downstream sewers. All solid and semi-solid materials dislodged during cleaning operations shall be captured and removed from the sewer by Contractor at the downstream manhole of the sewer section being cleaned. These materials shall become the property of the Contractor, shall be removed from the site at the end of each workday by the Contractor, and shall be disposed of in a lawful manner by the Contractor. The passage of dislodged materials from the segment being cleaned to the sewer segment located immediately downstream will not be permitted. In such an event, as observed or detected by the Owner/Owner's Representative, Engineer, or any third party, Contractor shall be responsible for cleaning the affected downstream sewers in their entirety at no additional cost to the Owner.

E. Disposal of Material: Contractor shall remove from the site and properly dispose of all solids and semi-solids recovered during the cleaning operation. The Contractor shall be responsible for the proper disposal of all collected material. Waste material removed from the sewer during the cleaning process may be disposed of by hauling it to the Owner's lagoon at Five Mile Creek WWTP. Specifics regarding the scheduling, monitoring, disposal fees (if any), and approved methods and procedures for disposal must be obtained from and coordinated with the Owner prior to the start of cleaning operations.

F. No sewer cleaning shall take place in a particular sewer segment until all upstream pipe segments have been cleaned. If cleaning is done in a downstream pipe segment in order to facilitate overall cleaning operations, the segment shall be re-cleaned prior to inspection by CCTV.

3.02 FIELD QUALITY CONTROL

A. Acceptance of this portion of the Work shall be dependent upon the results of the television inspection. The goal of the cleaning is to sufficiently remove debris, roots, and deposits to inspect the pipeline and provide at least 95 percent capacity of the pipeline. Sewers that are not sufficiently cleaned to permit television inspection shall be re-cleaned and re-inspected.

END OF SECTION

SECTION 33 05 06
MAIN SEWER PIPE AND FITTINGS

PART 1 GENERAL

1.01 SUMMARY

A. This section details the requirements for construction and testing of sanitary main sewers and appurtenances.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Water Works Association (AWWA):
   a. C110, Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. (75 mm Through 1200 mm), for Water.
   b. C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   c. C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. Through 12 in. (100 mm Through 300 mm), for Water Distribution.
2. ASTM International (ASTM):
   a. A746, Standard Specification for Ductile Iron Gravity Sewer Pipe.
   b. C150, Standard Specification for Portland Cement.
   c. C151, Ductile-Iron Pipe, Centrifugally Cast, for Water.
   d. D1784, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
   e. D2412, Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
   f. D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   g. D3212, Standard Specification for Joints For Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
   h. E329, Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
   i. F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
   j. F679, Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

1.03 DEFINITIONS

A. CCTV: Closed Circuit Television.

PART 2 PRODUCTS

2.01 GENERAL

A. All pipes and fittings shall have markings on the exterior to allow confirmation that they meet the requirements of this Specification. Markings shall include:

1. Nominal size and outside diameter.
2. Dimension Ratio (DR) or pressure rating as applicable.
3. ASTM and/or AWWA designation.
4. Manufacturer's name and production code indicating date of manufacturer and production shift time.

B. Pipe, unless otherwise approved shall be manufactured and tested domestically in the United States of America.

C. Fittings shall be manufactured and tested domestically or for fittings produced outside of the United States of America they shall bear the name of the domestic manufacturer supplying the pipe.

D. Pipe shall be new and recently manufactured. Refurbished pipe shall not be installed.

2.02 POLYVINYL CHLORIDE PIPE (PVC), C-900/C-905

A. For 12 inch and smaller:

1. In accordance with AWWA C-900, latest edition.
2. Pipe dimensions for each nominal size shall be with ductile iron equivalent outside dimension.
3. Joints: Integral bell and spigot.
4. Minimum DR: 18.
5. Cell Classification: 12454-B or 12454-C, as defined by ASTM D1784.
6. Fittings: Injection molded Class 150 PVC Fittings, AWWA C-907, manufactured with gasketed joints and designed for use with Pressure Class 150 AWWA C-900 pipes with ductile iron outside diameter.
7. Gaskets: Factory fabricated rubber compression type with solid cross section in accordance with ASTM F477. Lubricant for joining pipe as approved by pipe manufacturer.

B. For 14 inch through 18 inch:

1. In accordance with AWWA C-905, latest edition.
2. Pipe dimensions for each nominal size shall be with ductile iron equivalent outside dimension.
3. Joints: Integral bell and spigot.
4. Minimum DR: 18.

5. Cell Classification: 12454-B or 12454-C, as defined by ASTM D1784.
6. Fittings: Ductile Iron in accordance with the following section.
7. Gaskets: Factory fabricated rubber compression type with solid cross section in accordance with ASTM F477. Lubricant for joining pipe as approved by pipe manufacturer.

2.03 DUCTILE IRON PIPE

A. Meet requirements of AWWA C150/A21.50, AWWA C151/A21.51, and AWWA C111/A21.11.

B. Centrifugally cast, grade 60-42-10 iron.

C. Minimum pressure rating of pipe:

1. 12-inch and smaller 350 psi.
2. 14 to 18-inch 250 psi.

D. Joints: Push-on with rubber gaskets conforming to AWWA C111. Lubricant for joining pipe as approved by pipe manufacturer.

E. Fittings: Ductile iron conforming to AWWA C110. Lined and coated same as pipe.

F. Coating: Asphaltic type, 1 mil thick, in accordance with AWWA C150/A21.50, AWWA C151/A21.51, and AWWA C111/A21.11.

G. Lining: Permox CTF (White); Tnemec Perma-Shield PL Series 431 (Green); or Approved Equal.

H. Polyethylene Encasement (where detailed to be required on the drawings or otherwise specified):

1. Virgin polyethylene raw material conforming to requirements of ASTM D4976.
2. Elongation: 800 percent, minimum, in machine and transverse direction (ASTM D882).
3. Tensile Strength: 3,600 psi, minimum.
4. Dielectric Strength: 800V per mil-thickness, minimum.
5. Propagation Tear Resistance: 2,550-gram force (gf), minimum, in machine and transverse direction (ASTM D1922).
6. Tube Form: Conform to AWWA C105/A21.5.
7. Film: 0.008-inch (8 mil) thick, minimum.
8. Number of Film Layers: One.

2.04 TRANSITION FITTING

A. Connections where pipe materials change shall be made using a Romac 501 fitting or approved equal.

2.05 SERVICE LINE TO MAIN SEWER CONNECTOR

A. Tee of same material as main unless C900. For C900 connection shall be made with a ductile iron tee.

B. Romac CB.

C. Insert-A-Tee.

2.06 SERVICE END CAPP

A. For C900 and ductile iron pipe cap shall be a ROMAC Alpha Restrained End Cap, JMC 214 or equal.

B. For Schedule 40 PVC, A PVC end cap shall be solvent welded onto the end of the pipe.

2.07 CLEANOUT CAP

A. Geneco Products, Geneco Sewer Lateral Cleanout or approved equal.

2.08 PIPE TO MANHOLE CONNECTOR

A. In accordance with Section 33 05 13, Manholes.

PART 3 EXECUTION

3.01 EXAMINATION

A. No pipe or fittings shall be installed that have manufacturing imperfections or damage caused by improper handling.

B. Verify size, pipe condition, and pipe class prior to installation of pipe.

3.02 PREPARATION

A. Inspect pipe and fittings prior to lowering into trench to ensure no cracked, broken, or otherwise defective materials are being used.

B. Remove foreign matter and dirt from inside of pipe and fittings and keep clean during and after laying. Wash ends of section clean with wet brush prior to joining sections of pipe.

3.03 INSTALLATION

A. General:

1. Install pipe sections in accordance with manufacturer's recommendations.
2. Provide and use proper implements, tools, and facilities for safe and proper prosecution of Work.
3. Lower pipe, fittings, and appurtenances into trench, piece by piece, by means of crane, slings, or other suitable tools and equipment, in such a manner as to prevent damage to pipe materials, protective coatings and linings. Do not drop or dump pipe into trenches.

B. Line and Grade:

1. Establish line and grade for pipe by use of lasers.
2. Measure for grade at pipe invert, not at top of pipe.
3. Do not deviate from line or grade, more than 1/2 inch, provided that such variation does not result in a level or reverse sloping invert.

C. Laying and Jointing:

1. Use gasket lubricant as recommended by gasket manufacturer.
2. Lay pipe upgrade with bell ends pointing in direction of laying.
3. When field cutting or machining pipe is necessary, use only tools and methods recommended by pipe manufacturer and approved by.
4. After section of pipe has been placed in its approximate position for jointing, clean end of pipe to be joined, inside of joint, and rubber ring immediately before joining pipe.
5. Assemble joint in accordance with recommendations of manufacturer.
6. Apply sufficient pressure in making joint to assure that joint is "home" as defined in standard installation instructions provided by pipe manufacturer. Inside joint space shall not exceed 50 percent of pipe manufacturer's recommended maximum allowance.
7. Place pipe to specified line and grade to form smooth flow line.
8. Pipe shall not have a sag greater than 1/4 inch between successive pipe segments. Where the pipe has a sag greater than 1/4 inch between successive pipe segments or within 40-foot run, of pipe segment shall be reinstalled to eliminate the sag.
9. Ensure that bottom of pipe is in contact with bottom of trench for full length of each section.
10. Check for alignment and grade after joint has been made.
11. Place sufficient pipe bedding material to secure pipe from movement before next joint is installed.
12. When pipe is laid within movable trench shield, take precautions to prevent pipe joints from pulling apart when moving shield ahead.

13. When laying operations are not in progress, and at close of day's work close and block open end of last laid section of pipe to prevent entry of foreign material or creep of gasketed joints.
14. Take precautions to prevent "uplift" or floating of line prior to completion of backfill operation.

D. Connection to Structure or Manhole:

1. Locate standard pipe joint within 5 feet of outside face of structure.
2. Plug or close off pipe stubbed with watertight plug.

E. Connection to Main Sewer: Connection shall be installed at the required location using the specified fittings. Tapping of a new main sewer shall requires the approval of the Owner/Owner's Representative.

F. Crossing Waterlines: Where sewer crosses less than 18 inches below waterline, use ductile iron or PVC pressure pipe for crossing or encase in concrete envelope for a minimum distance of 9 feet on each side of waterline.

G. Ductile Iron Pipe:

1. Cutting and Dressing of Ductile Iron Pipe Ends:
   a. Cut at right angles to centerline of pipe to leave smooth end, without damage to pipe.
   b. Use only approved mechanical cutter.
   c. Taper cut end of pipe to be used with rubber gasket joints by grinding or filing 1/8 inch back at an angle of approximately 30 degrees with centerline of pipe.
   d. Remove sharp or rough edges.
   e. Abrade cut ends with grinding wheel and apply lining repair material. Use only compatible repair materials provided by pipe lining manufacturer. Allow repair lining to harden and cure before installation.
   f. Repair liner in accordance with manufacturer's recommendations.

H. Polyethylene Encasement:

1. Encase pipe, fittings, where pipe is to be concrete encased in accordance with AWWA C105/A21.5, Method C.
2. Pull encasement to take out slack and wrap snug around pipe.
3. Secure overlap in place and fold at quarter points of pipe length.
4. Wrap and tape encasement snug around fittings.
5. Encasement within sections of pipe installed in steel casings is not required.
6. For storm drain and utility crossings, when separation clearance is less than 24 inches, independent of the material of construction, for the section of the sewer main under an existing storm drain/pipe, plastic-wrap the main 5 feet on either side and bed and backfill to the invert of the storm drain with

CLSM (see Trench Backfill Specifications for CLSM). This is to ensure that the utility is properly supported and help prevent long-term issues from settlement of the utility or main sewer.

3.04 CLEANING

A. Clean each section of completed sewer pipeline prior to testing.

B. Place screen or dam in downstream manhole of section being cleaned to catch debris.

C. Remove material from each manhole section before cleaning the next section downstream.

3.05 TESTING AND INSPECTION

A. Leak Testing and CCTV Inspection shall be performed on all new main sewers. The following provides a summary of construction, Leak Testing and Inspection sequencing and requirements.

1. Prior to CCTV Inspection and Leak Testing of the new main sewer all utilities (gas, power, cable, fiber, telephone, etc.) that will cross the main sewer shall be complete. Timely acceptance of the main sewer by the Owner/Owner's Representative in some situations, due to scheduling/delays associated with other utilities, may require installation of casings where other utilities will be required to cross the main sewer. This will allow early, conditional acceptance of the sewer, upon completion of required CCTV Inspection and Leak Testing. Where utilities are installed that cross the main sewer by open cut or trenchless methods, after its inspection and testing, the contractor shall be required to repeat the CCTV and Leak Testing to confirm that the main sewer was not damaged by the work. The specific testing methods shall be determined by the County on a case by case basis.
2. Main Sewer Location:
    a. Outside of Road or Area to Receive Asphalt or Concrete Pavement: Upon completion of installation of main sewer, manhole(s) and backfilling to grade Contractor shall perform CCTV Inspection and Leak Test.
    b. Within Road or Area to Receive Asphalt or Concrete Pavement:
        1) Upon completion of installation of main sewer, manhole(s) and backfilling to grade Contractor shall perform CCTV and Leak Test.
        2) A performance test is required prior to finish paving. Manhole vacuum test after final paving to confirm no damage during paving.

B. Owner/Owner's Representative Inspections: Notify the Owner/Owner's Representative a minimum of 48-hours in advance of required inspection, CCTV and Leak Testing.

C. CCTV: Perform CCTV inspection in accordance with Section 33 01 30, Sewer Inspection for CCTV Inspection.

D. Leak Testing:

1. General:
    a. The Contractor shall provide all necessary water, equipment, and instrumentation for water flushing before testing. Source and quality of water, test procedures, and method of disposal of water shall all be submitted to the Owner/Owner's Representative for review and approval.
    b. Any other tests required by local plumbing codes or building authorities shall also be conducted independent of these tests.
    c. Main Sewer shall successfully pass leakage test prior to acceptance.
    d. All defective main sewers (those not passing the specified test) shall be repaired, or replaced, and retested until acceptable by the Owner/Owner's Representative. Repairs shall be made to the standard of quality specified for the entire system.
    e. Sections of the system may be tested separately. However, any defect which may develop in a section previously tested and accepted shall be promptly corrected and retested until acceptable to the Owner/Owner's Representative.
    f. Isolate new main sewers that are connected to existing sewers. Install pipe plugs as required to allow section of new pipe to be pressure tested.
    g. Plug wyes, tees, stubs, and service connections with gasketed caps or plugs shall be securely fastened or blocked to withstand internal test pressure. Such plugs or caps shall be removable, and their removal shall provide socket suitable for making flexible jointed lateral connection or extension.
    h. Testing equipment shall provide observable and accurate measurement of leakage under specified conditions.
    i. Main sewers may be tested using either the Pneumatic Procedure or the Hydrostatic Procedure.
2. Pneumatic Testing for Pipe:
    a. Equipment:
        1) Install compressor, air piping manifolds, gauges, and valves at final grade elevation.
        2) Provide pressure release device, such as rupture disc or pressure relief valve, to relieve pressure at 6 psi or less.
        3) Restrain plugs used to close sewer lines to prevent blowoff.

b. Procedure:

1) No person shall enter manhole or structure, or occupy area above opening of manhole or structure where pipe is under pressure.
2) Prior to any testing, all lines shall be cleaned of debris and flushed clean with water as necessary.
3) Determine height of groundwater table at time of test.
4) The line shall be sealed at each end. Service lines shall be capped securely at the Tee connection or at the right-of-way line as applicable. The seal at one end shall have an orifice through which to pass air into the pipe. An air supply shall be connected to the orifice. The air supply line will contain an on/off valve and a pressure gauge with a range from 0 to 10 psi. The gauge shall have minimum divisions of 0.10 psi, and shall have an accuracy of plus or minus 0.04 psi.
5) Slowly introduce air into pipe section until internal air pressure reaches 4 psi greater than average backpressure of groundwater submerging pipe. The line will be allowed to stabilize between 4 psig and 3.5 psig for a period of no less than 5 minutes. If necessary, air should be added to the line to maintain pressure above 3.5 psig.
6) Allow 2 minutes minimum for air temperature to stabilize.
7) After the stabilization period, the valve shall be closed.
8) Allowable leakage for sewers:
    a) When pressure is decreased to 3.5 psig, air pressure test shall begin.
    b) Test shall consist of measuring time in seconds for pressure in pipe to drop from 3.5 psig to 2.5 psig.
    c) Pipe leakage shall be considered acceptable if time in seconds for pressure drop is equal to or greater than required time as shown below:

Size of Pipe (inches)	**Minutes: Seconds per 100 ft**
4	3:00
6	3:00
8	4:30
10	6:00
12	7:30
18	9:00

9) If the pipeline to be tested is beneath the groundwater level, the test pressure shall be increased 0.433 psi for each foot the groundwater level is above the invert of the pipe.

3. Hydrostatic Exfiltration Test:
    a. Procedure:
        1) Maximum filling velocity shall not exceed 0.25 foot per second, calculated based on full area of pipe.
        2) Expel air from piping system during filling.
        3) Apply and maintain specified test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.
        4) Maintain hydrostatic test pressure continuously for 2 hours minimum, adding additional make-up water only as necessary to restore test pressure.
        5) Determine actual leakage by measuring quantity of water necessary to maintain specified test pressure for duration of test.
        6) Measurement Accuracy: Plus or minus 1/8 gallon of water leakage under specified conditions.
        7) PVC and ductile iron pipe and joints shall sustain maximum water loss limit of 0.8 gallon per inch diameter per 1,000 feet of pipe Allowable leakage shall be modified as stated below if hydrostatic head is other than 6 feet.
    b. Hydrostatic Head:
        1) No less than 6 feet above inside top of highest section of pipe in test section, including service connections.
        2) In every case, determine height of water table at time of test by exploratory holes or such other methods approved by Engineer. Engineer will make final decision regarding test height for water in pipe section being tested.
        3) If hydrostatic head is other than 6 feet, allowable leakage as computed by criteria above shall be adjusted by the square root of actual head divided by square root of 6.
    c. Length of Pipe Tested: Limit length such that pressure on invert of lower end of section does not exceed 16 feet of water column. In no case shall length be greater than 700 feet.
    d. Dispose of test water in a manner that will not damage or interfere with adjacent property and in a manner acceptable with Engineer and regulatory agencies.

END OF SECTION

SECTION 33 05 13
MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gravity sanitary sewer manholes and structures for housing valves.

1.02 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO): M198, Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
2. ASTM International (ASTM):
   a. A36/A36M, Standard Specification for Carbon Structural Steel.
   b. A48/A48M, Standard Specification for Gray Iron Castings.
   c. A536, Standard Specification for Ductile Iron Castings.
   d. A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   e. C31/C31M, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   f. C39/C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   g. C150/C150M, Standard Specification for Portland Cement.
   h. C443, Standard Specification for Joints for Concrete Pipe and Manholes Using Rubber Gaskets.
   i. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
   j. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
   k. C990, Standard Specification for Joints in Concrete Pipe, Manholes, and Precast Box Sections using Preformed Flexible Joint Sealants.
   l. C1244, Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.

PART 2 PRODUCTS

2.01 GENERAL

A. Unless otherwise specifically approved by the Owner/Owner's Representative, all manholes will be precast concrete manholes as specified herein.

B. All manholes shall have precast openings in the manhole walls with integrated seal for incoming or outgoing sewers at the elevations and locations indicated on the Drawings.

C. All components of a manhole for a particular location shall be clearly marked in order that the manhole may be correctly assembled to suit construction conditions existing at that particular location.

D. Materials of Construction and Service Conditions:

1. Screws, Bolts, or Nuts: Type 304 stainless steel conforming to ASTM F593 and ASTM F594.
2. Gaskets: Internal and external seals shall be made of materials that have been proven to be resistant to the following exposures and conditions:
    a. Sanitary sewage.
    b. Corrosion or rotting under wet or dry conditions.
    c. Gaseous environment in sanitary sewers and at road surfaces including common levels of ozone, carbon monoxide, and other trace gases at installation site.
    d. Biological environment in soils and sanitary sewers.
    e. Chemical attack by road salts, road oil, and common street spillages or solvents used in street construction or maintenance.
    f. Temperature ranges, variations, and gradients in construction area.
    g. Variations in moisture conditions and humidity.
    h. Fatigue failure caused by a minimum of 30 freeze-thaw cycles per year.
    i. Vibrations because of traffic loading.
    j. Fatigue failure because of repeated variations of tensile, compressive and shear stresses, and repeated elongation and compression. Material shall remain flexible allowing repeated movement.
3. Materials shall be compatible with each other and manhole materials.
4. Designed to provide a 50-year service life.

E. Structures shall meet requirements of ASTM C478, this Specification and the following:

1. Concrete:
    a. Cement: Meet requirements of ASTM C150/C150M.
    b. Compressive Strength:
        1) Minimum 4,000 psi.
        2) Minimum strength shall be confirmed at 7 days or earlier by making two standard cylinders per manhole for testing.
    c. Shall contain type II Portland with a C3A content of 5.5 percent or less.
    d. Concrete mix design shall include:

1) Xypex C-500 or C-1000 at a dosage of 2 to 3 percent or based upon mix design at dosage recommended by manufacturer.
2) Pink dye to indicate that the concrete mix / manhole contains the Xypex admixture.

2. Reinforcement: Grade 60, unless otherwise specified.
3. Ring: Custom made with openings to meet indicated pipe alignment conditions and invert elevations.
4. Floor: Minimum 4 inches below pipe to provide clearance for grouting channels.
5. Joint:
   a. Form joint contact services with machined castings.
   b. Surfaces shall be parallel with nominal 1/16-inch clearing and tongue equipped with recess for installation of Tylox-Super Seal gasket.
6. Gasket: Meet requirements of ASTM C443.
7. Surfaces: Interior and exterior surfaces shall have smooth hard finish and shall be free from cracks, chips and spalls.

2.02 PRECAST MANHOLES

A. Riser Sections:

1. Fabricate in accordance with ASTM C478.
2. All riser sections shall be supplied with manhole Lift System inserts as manufacturer by Press-Seal Gasket Corporation or approved equal. Lifting eyebolts, also manufactured by Press-Seal Gasket Corporation or approved equal, shall be supplied to the Contractor upon request.
3. Diameter: Minimum 48 inches. Other acceptable diameters include 60-, 72-, 84- or 96-inch, depending on design requirements.
4. Heights: Range from 12-inch or 16-inch to 48-inch, in 12-inch or 16-inch multiples. The use of 12-inch or 16-inch risers shall be minimized and shall only be used to adjust to final grade.
5. Wall Thickness: Minimum 4 inches or 1/12 times inside diameter, whichever is greater.
6. Top and bottom surfaces shall be parallel.
7. Joints: Tongue-and-groove and confined Tylox Super Seal rubber gaskets meeting ASTM C443.

B. Cone Sections:

1. Shall be concentric. Eccentric and flat top slab sections will be allowed only with the approval of the Owner/Owner’s Representative.
2. Same wall thickness and reinforcement as riser section.
3. Top and bottom surfaces shall be parallel.
4. Conical sections shall transition to a clear access opening for support of the manhole frame and be either 24, 36 or 46 inches high.

5. Section shall be supplied with manhole Lift System inserts as manufacturer by Press-Seal Gasket Corporation or approved equal.
6. Where bolt-down manhole frame and covers are indicated on the Drawings, conical sections shall be supplied with four stainless steel anchor bolts.

C. Base Sections and Base Slab:

1. Base slab integral with sidewalls.
2. Fabricate in accordance with ASTM C478.
3. May be supplied in 48-, 60-, 72-, 84- or 96-inch diameters.
4. Heights shall range from 24 inches to 94 inches depending on availability with diameter and as specified or approved by the Design Engineer.
5. All base sections shall be supplied with manhole Lift System inserts as manufacturer by Press-Seal Gasket Corporation or approved equal. Lifting eyebolts, also manufactured by Press-Seal Gasket Corporation or approved equal, shall be supplied to the Contractor upon request.
6. Pipes shall be sealed in base using flexible connection.
7. In areas with a high groundwater table an extended shall be used. Designer shall confirm that uplift will not be an issue.

D. Transition Sections:

1. Conical transition sections shall be supplied for 60 inch to 48-inch diameter transitions. Conical transitions shall be 32 or 36 inches high. Shorter conical transitions may only be used when specifically approved by the Owner/Owner's Representative. All conical transition sections shall be supplied with manhole Lift System inserts as manufacturer by Press-Seal Gasket Corporation or approved equal.
2. Flat slab transitions shall be supplied for base sections 72 inches to 96 inches in diameter. Flat slab transitions shall be manufactured structurally to meet individual project requirements. Clear access openings shall be provided to accommodate riser sections as specified in individual Project Drawings and Specifications.

E. Joint Straps: The Contractor shall install manhole joint straps on each section of manholes with bolt down /watertight covers and on manhole cone sections where cone section is exposed. Bolted together manhole joints shall be permanently strapped utilizing three bitumastic coated steel strap anchors located 120 degrees circumferentially per Detail 3305-615.

F. Joint Seal Manufacturers and Products:

1. Waterstop Sealant: Conseal CS-231 waterstop sealant as manufactured by Concrete Sealants.
2. Confined Plastic or Rubber profile Gasket:
   a. Meet requirements of ASTM C443.

b. Hamilton Kent, Sparks, NV; Tylox Super Seal pre-lubricated gasket.

3. External Wrap:
   a. General: Minimum external wrap width is 6 inches.
   b. Manufacturers/Products:
      1) Sealing Systems, Inc., Loretto, MN; Gator Wrap.
      2) Henry Company, Houston, TX; RU116 Rubr-Nek External Joint Wrap.
      3) Trelleborg Engineered Solutions, Park Hills, MO; NPC External Joint Wrap.
      4) Cretex Specialty.

G. Precast concrete manhole manufacturers: A list of approved manufacturers may be obtained from the Owner/Owner's Representative.

H. Polypropylene Steps:

1. Fabricate from minimum 1/2 inch, Grade 60, steel bar meeting ASTM A615/A615M.
2. Polypropylene encasement shall conform to ASTM D4101.
3. Minimum Width: 13 inches, center-to-center of legs.
4. Embedment: 3-1/2-inch minimum and 4-1/2-inch minimum projection from face of concrete at point of embedment to center of step.
5. Cast in manhole sections by manufacturer. Installed at maximum 16-inch intervals.
6. Load Test: Capable of withstanding ASTM C478 vertical and horizontal load tests.
7. Model PS1 PF, as manufactured by M.A. Industries, Inc.

2.03 PIPE CONNECTIONS AT MANHOLES

A. Openings in new manhole walls for incoming and outgoing sewers shall be precast. Coring is allowed only for connection to an existing manhole or when differing site conditions are encountered for new manholes.

B. New Manholes:

1. Manufacturer/Products:
   a. Z-Lok, A-Lok Products, Tullytown, PA.
   b. A-Lok Premium, A-Lok Products, Tullytown, PA.
   c. NPC, Kor-N-Seal, Series 106-406, Milford, NH.
   d. Approved equal.

C. Existing Manhole:

1. Openings into existing manholes for incoming and outgoing sewers shall be cored.
2. Manufacturers/Products:

a. Inserta –Lok, A-Lok Products, Tullytown, PA.
b. G3, A-Lok Products, Tullytown, PA.
c. NPC, Kor-N-Seal, Series 106-406, Milford, NH.
d. Approved equal.

D. Alternates may be approved by the Owner/Owner's Representative on a case by case basis.

2.04 MANHOLE FRAMES AND COVER

A. General:

1. Made in the United States.
2. Made of materials from the United States.
3. Shall be "Heavy Duty" type, rated for a minimum of H-20 loading.
4. Seating surfaces shall be machined flat to ensure contact between cover and frame along the full perimeter, in accordance with Federal Specification RR-F-621.

B. Castings:

1. Tough, close-grained gray iron, sound, smooth, clean, free from blisters, blowholes, shrinkage, cold shuts, and defects.
2. Cast Iron: ASTM A48/A48M Class 30B.
3. Plane or grind bearing surfaces to ensure flat, true surfaces.
4. Tolerances shall be plus or minus 1/16 inch, with an additional 1/16-inch per foot of dimension.
5. Castings determined to be defective by the ESD shall be replaced prior to acceptance.

C. Cover:

1. Owner's Standard.
2. True and seat within ring at all points.
3. With the most recent version of the emblem of Jefferson County. No substitute cover designs will be accepted.
4. Cast with two non-penetrating pick-holes of the Owner's standard dimensions.
5. Shall not have vent holes.
6. Cast with four stacking lugs, each with 5/8-inch wide by 2 inches long, on the bottom of the lid.

D. Frames:

1. Shall have integrally cast, full perimeter mud rings.
2. Cast with four 1-inch diameter holes in the flange for anchor bolts, located according to County standards.

3. For bolt-down type covers, frames shall be cast and machined to accept four holes, 3/4-inch diameter, to accommodate the Owner's standard for anchor bolts.
    a. Bolts shall be stainless steel, 5/8-inch – 11 by 2-inch hex-head cap screws, and shall be provided with all bolt-down covers.
    b. Bolts shall include stainless steel washers and rubber sealing gaskets.
4. Gasket: Flat, 1/8-inch thick, black neoprene with a minimum tensile strength of 2,000 psi.
5. Secured to the seating surface of the frame with a non-degrading glue by the manufacturer.

E. Frame and cover manufacturers:

1. Approved models include:
    a. East Jordan Ironworks/Vulcan Foundry #V-2480 (bolt-down cover).
    b. East Jordan Ironworks/Vulcan Foundry #V-1480 (standard cover).
    c. US Foundry #368-ES (standard cover).
    d. US Foundry #367-EQ (bolt-down cover).

2.05 MANHOLE FRAME CONNECTION AND SEAL TO STRUCTURE

A. Butyl Sealant:

1. Conform to ASTM C1311, or AASHTO M198 and ASTM C990.
2. Trowelable or cartridge applied.
3. Manufacturers and Products:
    a. Tremco Commercial Sealants and Waterproofing, Beachwood, OH; Tremco Butyl Sealant.
    b. Bostik, Middleton, MA; Chem-Calk 300.
    c. Press-Seal Gasket Company, Fort Wayne, IN; EZ-Stik #3.
    d. Approved equal.

B. External Wrap:

1. Meet requirements of ASTM C923.
2. Construct of high quality rubber that will provide flexible watertight seal around joint.
3. Thickness: Minimum 60 mils.
4. Consist of a top and bottom section and be sealed to structure, frame top, and bottom with mastic as applicable.
5. Length: Extend from manhole frame and extension ring to cone section.
6. Bands: If required, constructed of minimum 16-gauge sheet if channeled, or 5/16-inch diameter if round.
7. Manufacturers and Products:
    a. Sealing Systems, Inc., Loretto, MN; Infi-Shield.
    b. Trelleborg Engineered Systems, Milford, NH; NPC Flexrib Frame-Chimney Seals.

c. Cretex Specialty Products, Waukesha, WI; X-85 Seal.

C. Internal Wrap or Sealing Membrane:

1. Meet requirements of ASTM C923.
2. For rehabilitation of existing manholes or where called for specifically by ESD.
3. Minimum internal thickness of 3/16 inch or as recommended by manufacturer for installation climate.
4. Designed for application and have a demonstrated history of accommodating differential expansion between frame and concrete.
5. Width: Minimum 8 inches.
6. Expansive type wraps shall be fabricated of high quality rubber or urethane.
7. Bands: If required, constructed of minimum 16-gauge sheet if channeled, or 5/16-inch diameter if round.
8. Wrap shall not restrict access to manhole.
9. Manufacturers and Products:
   a. Sealing Systems, Inc., Loretto, MN; Flex-Seal Utility Sealant.
   b. Trelleborg Engineered Systems, Milford, NH; NPC Flexrib Frame-Chimney Seals.
   c. Cretex Specialty Products, Waukesha, WI; Internal Manhole Chimney Seal.

2.06 BRICK

A. General:

1. Bricks with holes through them will not be allowed.
2. Used to adjust manhole frame to grade.
3. Shall conform to ASTM C32 for grade SM.
4. Conform to the following, unless otherwise approved by Owner/Owner's Representative:
   a. Shall be new and whole, of uniform standard size and with straight and parallel edges and square corners. Bricks shall be of compact textures, burned hard entirely through, tough and strong, free from injurious cracks and flaws and shall have a clear ring when struck together.
   b. No soft or salmon brick shall be used.

2.07 MASONRY

A. Conform to ASTM C90, Grade N, Type I or II, for hollow load bearing blocks.

2.08 MORTAR

A. Prepared only in the quantities needed for immediate use.

B. Any mortar mixed for more than 30 minutes or which has set or has been retempered shall not be used.

C. Standard premixed in accordance with ASTM C387/C387M, or proportion one part Portland cement to two parts clean, well-graded sand that will pass a 1/8-inch screen.

2.09 PRECAST CONCRETE GRADE RING

A. Minimum wall thickness of 1/12 of the internal diameter of the grade ring or 4-inches, whichever is greater.

B. Minimum reinforcing steel area of 0.07 square inches per vertical foot but not less than 0.024 square inches in any ring.

C. Minimum concrete cover of 1 inch over all steel.

D. Keyed to help lock ring in place and seal ring.

E. Minimum height shall be 4 inches.

2.10 MONOLITHIC LINING

A. In accordance with Section 09 66 01, Monolithic Lining of Manholes and Pump Station Wet Wells.

PART 3 EXECUTION

3.01 GENERAL

A. Prior to installation inspect materials:

1. Sections not meeting requirements of this Specification or that are determined to have defects which may affect durability of structure are subject to rejection.
2. Sections damaged after delivery will be rejected and if already installed shall be repaired to satisfaction of Owner and Engineer.
3. Remove and replace structure that cannot be repaired.

B. If needed, dewater excavation during construction and testing operations.

3.02 BEDDING AND BACKFILL

A. Bedding:

1. All precast concrete manhole base sections and drop manhole bases shall be set on a foundation of No. 57 compacted stone aggregate, 12-inch minimum thickness and covering the entire bottom of the

excavation for the manhole. Aggregate size may be adjusted by the Owner/Owner's Representative based on field conditions.

2. Where soft soil is encountered or the structure is being placed in the field the services of a geotechnical engineer shall be used to confirm that the soil is compacted to 95 percent in accordance with ASTM D698. Geotechnical engineer shall specify modifications/improvements as required to prevent settlement.

B. Backfill:

1. Outside of Pavement: Backfill around structure with earth fill to lines and grades shown; allow for topsoil thickness where shown. Place in 8-inch thick maximum lifts. Compact each lift to 92 percent relative compaction as determined in accordance with ASTM D698.
2. Within Pavement: Backfill around structure with No. 57 stone aggregate. Place in 12-inch lifts and compact.

3.03 INSTALLATION OF PRECAST MANHOLES

A. Concrete Base:

1. Precast:
   a. Place on compacted structural fill.
   b. Properly locate, ensure firm bearing throughout, and plumb first section.

B. Sections:

1. Inspect precast manhole sections to be joined.
2. Clean ends of sections to be joined.
3. Do not use sections with chips or cracks in tongue.
4. Locate precast steps in line with each other to provide continuous vertical ladder.

C. Preformed Plastic Gaskets or Rubber profile gaskets:

1. Use only pipe primer furnished by gasket manufacturer.
2. Install gasket material in accordance with manufacturer's instructions.
3. Completed Manhole: Rigid and watertight.

D. External Joint Wraps:

1. External wraps required on all manholes located in areas below 100 year flood elevation and additional locations as directed by the ESD.
2. Install in accordance with manufacturer's instructions.

E. Extensions:

1. Grade Rings: Provide on manholes in streets or other locations to match final specified grade.
2. Frame: Set frames in three equally spaced beads of butyl sealant that run full circumference of frame.
3. Wrap: Install exterior manhole frame to structure seals in accordance with manufacturer's instructions. Seal shall cover grade rings.
4. Cover: Install in accordance with manufacturer's recommendations.
5. Concrete grade rings damaged during installation shall be replaced.

3.04 MANHOLE INVERT

A. Construct with smooth transitions to ensure unobstructed flow through manhole. Remove sharp edges or rough sections that tend to obstruct flow.

B. Precast manhole inverts are allowed. If invert is not correct manholes will be rejected. If a precast invert is provided, field modification is not allowed.

3.05 MANHOLE FRAMES AND COVERS

A. Grade Adjustment:

1. Install to height not exceeding 6 inches on new manholes.
2. Where adjustment to existing manhole is required height shall not exceed 15-inches. Where exceeds 15-inch riser section shall be installed or require manhole replacement when the existing material is brick.
3. Place brick using mortar a minimum of 2 wide to provide full support for manhole frame.

B. Set frames in three equally spaced beads of butyl sealant that run full circumference of frame.

C. For water tight frame and cover, anchor frame to manhole with specified bolts.

D. Install interior or exterior manhole frame to structure seals as directed by the Engineer in accordance with manufacturer's instructions. Seal shall cover grade rings.

3.06 MANHOLE PIPING

A. Drop Assembly: See Drawings for detail of installation requirements.

B. Flexible Joints:

1. Provide in pipe not more than 1-1/2 feet from manhole walls.
2. Where last joint of pipe is between 1-1/2 feet and 6 feet from manhole wall, provide flexible joint in manhole wall.

C. Stubouts for Future Connections:

1. Provide same type and class of pipe as specified for use in service connection, lateral, main, or trunk sewer construction. Where there are two different classes of pipe at manhole use higher strength pipe.
2. Grout pipe in precast walls or manhole base to provide watertight seal or use flexible joints as specified herein.
3. Maximum Length: 5 feet outside manhole wall.
4. Test Plugs:
    a. Install rubber-gasketed plugs in end of stubouts with gasket joints similar to sewer pipe being used.
    b. Plugs shall withstand internal or external pressures without leakage.
    c. Adequately brace plugs against hydrostatic or air test pressures.

D. Permanent Plugs: Clean interior contact surfaces of pipes to be cut off or abandoned as shown, and construct plug as follows:

1. Pipe 18 Inches or Less in Diameter: Concrete plug in end, minimum 2 feet long.
2. Pipe 20 Inches and Larger: Concrete plug in end, minimum 4 feet long.
3. Plugs shall be watertight and capable of withstanding internal and external pressures without leakage.

3.07 MANHOLES OVER EXISTING PIPING

A. Maintain flow through existing pipelines at all times.

B. Concrete Pipe: Apply bonding agent on surfaces in contact with concrete.

C. Construct base under existing piping.

D. Construct manhole as detailed in Drawings.

E. Apply minimum of two complete wraps of hydrophilic waterstop centered on pipe in wall.

F. Place a minimum of 24 inches of concrete around each pipe penetration outside manhole against undisturbed soil or compacted aggregate unless otherwise detailed.

G. Grout channel through manhole.

H. Saw cut out or demolish existing pipe within new manhole using method approved by Owner/Owner’s Representative.

I. Protect new concrete or grout for 7 days after placing concrete.

3.08 CONNECTIONS TO EXISTING MANHOLES

A. Condition Assessment:

1. To allow connection to an existing manhole it must be in good condition. Condition shall be confirmed with the Owner/Owner's Representative.
2. Where determined that manhole is poor condition it shall be replaced. Coring and connection to a manhole in poor condition is not allowed.

B. Replacement Manhole:

1. Replacement manhole shall meet the requirements of this Specification.
2. Replacement of up to 10 feet of existing inflow and outflow pipe(s) shall be considered part of the manhole replacement.

C. Existing Manhole:

1. Core manhole bases and grouting as necessary.
2. Seal pipe in manhole using flexible connector.
3. Regrout to provide smooth flow into and through manholes.
4. Provide diversion facilities and perform work necessary to maintain flow during connection.

3.09 MONOLITHIC LINING

A. Install lining in accordance with Section 09 66 01, Monolithic Lining of Manholes and Pump Station Wet Wells. This shall be installed after completion of manhole testing to confirm the integrity of the structure.

3.10 TESTING AND INSPECTION

A. All new manholes shall be tested and inspected. The following provides a summary of construction and inspection sequencing and requirements:

1. Prior to Inspection and Testing of manholes all utilities (gas, power, cable, fiber, telephone, etc.) that will cross the main sewer and/or be located within 8 feet of manholes shall be complete. Timely acceptance of the main sewer by the Owner/Owner's Representative in some situations due to scheduling/delays associated with other utilities, may require installation of casings where other utilities will be required to cross the main sewer or be located in close proximity to manholes. This will allow early, conditional acceptance of the sewer, upon completion of required CCTV Inspection and Leak Testing. Where utilities are installed that cross the main sewer or in close proximity to manholes by open cut or trenchless methods, after its inspection and testing, the contractor shall be required to repeat the Testing to confirm that the manhole was not damaged by the work. The specific testing methods shall be determined by the County on a case by case basis.

2. Manhole Location:
   a. Outside of Road or Area to Receive Asphalt or Concrete Pavement: Upon completion of installation of main sewer and manhole and backfilling to grade Contractor shall Manhole Test.
   b. Within Road or Area to Receive Asphalt or Concrete Pavement:
      1) Upon completion of installation of main sewer and manhole and backfilling to grade Contractor shall perform Manhole Inspection.
      2) Upon completion of final paving repeat Manhole Test.

B. Owner/Owner's Representative Inspections: Notify the Owner/Owner's Representative a minimum of 48-hours in advance of required inspection, CCTV and Leak Testing.

C. Manhole Testing:

1. Conduct negative air pressure (vacuum) test on all manholes in accordance with ASTM C1244, following the manufacturer's recommendations for proper and safe procedures. Conduct tests in presence of the Owner/Owner's Representative Inspector.
2. All pipe openings shall be sealed by installing suitable plugs that completely isolate the manhole structure. Any other openings such as lifting holes shall be permanently sealed.
3. Procedure:
   a. A suitable vacuum pump shall be connected at the top access point of the manhole.
   b. A vacuum of 10 inches of mercury (Hg) (5.0 psi) shall be drawn on the manhole.
   c. The time shall be measured for the vacuum to drop to 9 inches of mercury (Hg) (4.5 psi).
   d. Manholes will be considered to have failed if the time to drop 1 inch of mercury is less than what is shown in the following table:

Vacuum Test Timetable				
	Manhole Diameter			
Depth (ft)	**48-inch**	**60-inch**	**72-inch**	**96-inch**
4	10 sec	13 sec	16 sec	19 sec
8	20 sec	26 sec	32 sec	38 sec
12	30 sec	39 sec	48 sec	57 sec
16	40 sec	52 sec	64 sec	76 sec
20	50 sec	65 sec	80 sec	95 sec
+ Each 2'	+5.0 sec	+6.5 sec	+8.0 sec	+9.5 sec

e. Manhole depths shall be rounded to the nearest foot.
f. Intermediate values shall be interpolated.
g. For depths above 20 feet, add appropriate values from table for each additional 2 feet of depth.

4. All manholes that fail the test or that have visible leakage in the manhole, even if passing the test, shall be repaired or replaced until the manhole passes the test, to the complete satisfaction of the Owner/Owner's Representative. Manholes with visible leaks will not be accepted under any circumstances.

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SECTION 33 70 00
WASTEWATER FLOW CONTROL

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall design and provide all materials, labor, supervision, maintenance, equipment, fuel, fuel storage, etc. required to implement temporary bypass pumping for the purpose of diverting existing wastewater flows around portions of the work area for the entire duration of the project, or portions thereof, when his activities interfere with normal functioning of the sanitary sewer system and associated facilities in any way.

B. The design, installation, and operation of each temporary bypass pumping system shall be the Contractor's responsibility throughout the duration of the project. The Contractor shall employ the services of a vendor who can demonstrate to the Owner and/or Engineer that he specializes in the design and operation of temporary bypass pumping systems. The vendor shall provide at least five references of projects of a similar size and complexity as this Project performed by his firm within the past three years. All components of the temporary bypass pumping system shall be provided to the Contractor by a single vendor.

C. The bypass system shall meet the requirements of all local, state, and/or federal codes and regulatory agencies having jurisdiction.

D. In the event, during the performance of any form of wastewater flow control, that raw wastewater or other liquids/solids being bypassed are spilled, discharged, leaked, or otherwise deposited into the open environment, including, but not limited to, on the ground, on roadways, into creeks, and/or into storm sewers, due to the Contractor’s work, the Contractor shall be responsible for the cleanup of these liquids/solids and stabilization of the area affected, all in compliance with any and all regulatory requirements. The Contractor shall immediately notify the Owner and/or Engineer of the spill/discharge/leak/deposit after it occurs and shall immediately correct the violation. The cleanup and stabilization work shall be performed at the Contractor’s expense with no additional cost to the Owner. If the Owner and/or Engineer is required to alleviate any prohibited spill/discharge/leak/deposit, the Contractor shall be charged the Owner’s cost times two, which shall be deducted from the Contract Amount. The Contractor shall also be responsible for any fines imposed by local, state, and/or federal agencies for failure to maintain flows or contain spills and/or overflows due to the Contractor’s work.

E. If, at any time, the Contractor is unable to properly bypass pump the wastewater, construction will be stopped until the Contractor is able to continue work in an acceptable manner. The Contractor will not receive extra Contract Time for delays caused by improper equipment, labor, or breakdowns.

F. When the Contractor is actively performing work on a specific sanitary sewer interceptor, Contractor shall be responsible for maintaining the specific sanitary sewer interceptor in service without wastewater spills during the entirety of the construction period when the bypass pumping system is NOT in operation.

G. The Contractor shall implement best management practices to prevent and minimize erosion and resultant sedimentation during all bypass pumping activities in accordance with Section 02270 – Slope Protection and Erosion Control.

H. Contractor shall be responsible for any and all damages caused to any and all portions of the existing sanitary sewer system where the Contractor is actively working as a result of surge during the entirety of each bypass pumping operation.

I. Contractor shall not be allowed to let active main line sewers empty or spill into open trenches during execution of the work. All main line sewers connecting upstream from a line being repaired or replaced shall be plugged and bypassed. The bypassed flow shall be routed to the existing sewer downstream from the work in a manner that does not allow flow to backup into the work area. Some leakage may be allowable only if (in the opinion of the on-site inspector) it is unavoidable.

J. Contractor shall dispose of sewage contaminated soil in the trench by removing the containing soil (generally below the crown of the pipe), dewatering the soil, and spreading and or dumping the soil at a State approved disposal site.

K. Contractor shall immediately cleanup the area of an SSO, remove and dispose of debris, then place lime over the contaminated area.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01010 – Summary of Work

B. Section 01015 – Prosecution and Progress

C. Section 01300 – Submittals

D. Section 01510 – Temporary Utilities

E. Section 01530 – Protection of Existing Facilities

F. Section 01570 – Traffic Regulation

G. Section 31 32 00 – Slope Protection and Erosion Control

H. Section 40 27 01 – Ductile Iron Pipe

I. Section 40 27 02 – High Density Polyethylene (HDPE) Pipe

1.03 SUBMITTALS

A. Bypass Pumping Plan: The Contractor shall submit to the Owner and/or Engineer, for review and approval, detailed drawings and descriptions outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing wastewater flows for each bypass pumping operation that will be performed. The plan must be specific

and complete, including such items as schedules, locations, elevations, capacities of equipment, materials, and all other incidental items necessary and/or required to ensure proper protection of the facilities, including protection of the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions specified in these Contract Documents. Bypass pumping equipment and materials shall not be installed until all equipment, materials, provisions, and requirements have been reviewed and approved by the Owner and/or Engineer. The Bypass Pumping Plan shall include, but shall not be limited to, the following:

1. Staging areas for pumps

2. Plugging methods and types of plugs

3. Number, size, material, method of installation, and location of suction piping

4. Number, size, material, method of installation, and location of discharge piping

5. Bypass pump sizes, capacities, number of each size to be on site, basis of selection, and power requirements

6. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range)

7. Standby diesel engine size and location

8. Thrust and restraint block sizes and locations

9. Sections showing suction and discharge pipe depth, embedment, select fill, and special backfill

10. Method of noise control for each pump and diesel engine

11. Any temporary pipe supports and anchoring required

12. Design for access to bypass pumping locations indicated on the Drawings or in the Specifications

13. Selection of bypass pumping pipe size(s) and material(s) (include method of connections to pump(s) and other piping)

14. Schedule for installation of and maintenance of bypass pumping lines

15. Description of how bypass pumping system will be manned and monitored during all times it is in operation

16. Demonstration that upstream pipelines, structures, etc. will not overflow from surcharging

17. Demonstration that force main discharge will not overflow downstream pipelines,

structures, etc.

18. Show 100% standby for pumps.

19. Show force main pipe material and thickness can withstand all normal operating and surge pressures with a safety factor of 2.0.

20. Denote any conditions that will cause pumps to lose suction lift (prime) and describe procedures to rectify.

21. Show that the emergency switchover from primary to secondary pumping will be automatic should equipment fail.

22. Show emergency plan to be used if flooding occurs at work site.

23. Show suction and discharge piping is protected from possible damage from construction activities.

24. Show any planned shifting of bypass equipment during construction.

25. The start date, duration, and end date of the temporary bypass pumping operations

B. Shutdown Plan: Submit a Shutdown Plan for each bypass pumping operation to be performed in accordance with Section 01300 – Submittals.

PART 2 -- PRODUCTS

2.01 PUMPING EQUIPMENT

A. Contractor shall provide the bypass pumping system from one of the following vendors:

1. Godwin Pumps by Xylem Corporation

2. Rain for Rent

3. Sunbelt Rentals

B. General:

1. The sanitary sewer interceptors to be replaced under this Project are an integral part of the Owner's wastewater system that must be kept in service at all times. It is essential to the operation of the existing wastewater system that there shall be no interruption in the conveyance of wastewater to, through, and from the sanitary sewer interceptors to be replaced throughout the duration of the project. The Contractor shall provide, maintain, and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and backup units as required), piping, and all other labor and equipment necessary to intercept the wastewater flow before it

reaches the point where it would interfere with the Work or a portion thereof, carry it past the Work or the portion thereof, and return it to the existing system downstream of the Work or portion of the Work.

2. It shall be the Contractor's responsibility to provide pumping equipment that is adequate for the performance of the Work or portions thereof under this Contract within the time specified. All pumping equipment shall be kept in satisfactory operating condition, shall be capable of safely and efficiently performing the required bypass pumping work, and shall be subject to review by the Owner and/or Engineer at any time within the duration of the Contract. All bypass pumping work hereunder shall be performed in strict accordance with all applicable requirements of OSHA and local agencies.

3. Sanitary sewer system operational requirements take precedence over Contractor activities. Therefore, interruption of operations must be coordinated with and are subject to the operational requirements of the Owner and/or Engineer in accordance with Section 01530 – Protection of Existing Facilities.

4. The Contractor shall provide any and all temporary utilities and services required for operation of the bypass pumping equipment, shall maintain these utilities and services during the Contract period, and shall remove them upon completion of the Work, all in accordance with Section 01510 – Temporary Utilities.

5. Pumps shall be fully-automatic, self-priming units that do not require the use of foot valves, vacuum pumps, or diaphragm pumps in the priming system.

6. The duty pump(s) and the backup pump(s) shall be diesel-powered.

    a. Contractor shall be responsible for providing and storing a sufficient quantity of diesel fuel on-site to operate the duty pump(s) for a minimum of 24 hours at all times during performance of the Work.

    b. Contractor shall check the level in the diesel fuel tank(s) and shall re-fill the tank(s) to full capacity on a daily basis.

7. All pumps used shall be constructed to allow dry running for long periods of time to accommodate the cyclical nature of the flows.

8. Each pump and driver shall be rated for continuous duty operation over the specified range of conditions without cavitating or overheating and without excessive vibration or noise. In addition, each pump and driver shall be rated to intermittently operate at shut-off head against a closed discharge valve for periods of not less than five (5) minutes without excessive cavitation, overheating, or vibration.

9. All pumps shall be equipped with sound attenuation measures which reduce noise levels to a maximum of 75 decibels at a distance of 50 feet from the equipment during all periods of operation. If equipment is operated between the hours of 8:00

p.m. and 6:00 a.m., the equipment shall also be provided with a sound attenuation enclosure consisting of a three-sided enclosure with a roof constructed of a 2-inch x 4-inch lumber frame with 1/2-inch plywood sheathing and 2-inch styrofoam panels attached to the inside of the entire enclosure. The enclosure shall be portable to allow the enclosure to be moved when bypass pumping equipment is moved.

10. Contractor shall provide the necessary stop/start controls for each pump.

11. Contractor will not be permitted to stop or impede any flows to, through, or from the sanitary sewer interceptors under any circumstances, except as approved by the Owner and/or Engineer.

B. Temporary Bypass Pumping Requirements: The Contractor shall be responsible for providing the temporary bypass pumping facilities as described herein. Requirements for the bypass pumping system are as follows:

1. Bypass pumping system shall be continuously operated while modifications are being made to the specific sanitary sewer interceptor around which flow is being bypassed. Bypass pumping system shall be manned and monitored onsite at all times the system is in operation.

2. At a specific bypass pumping operation, the bypass pumping equipment shall be capable of pumping raw wastewater at a rate approved by the Owner and/or Engineer. Prior to starting any specific bypass pumping operation, Contractor shall confirm with the Owner and Engineer that the flows stated therein are acceptable. If instructed by the Owner and/or Engineer, Contractor shall increase the capacity of a specific bypass pumping operation to also handle additional flows that may occur during periods of rainstorms.

3. For each bypass pumping operation, Contractor shall determine the number of pumps required to convey the approved bypass pumping flow. Contractor shall provide a backup pump for the bypass pumping system. The backup pump shall be piped into the suction and discharge headers for the primary bypass pumping system and shall be online and isolated from the primary system by a valve.

4. The Contractor shall provide all pipeline plugs, pumps of adequate size to handle peak flow, and temporary discharge piping to ensure that the total flow for the specific sanitary sewer interceptor to be bypassed can be safely diverted around the work area while the sanitary sewer interceptor is being modified. No leakage from valves, piping, and connections will be allowed during operation.

5. The Contractor shall make all arrangements for bypass pumping during the time periods when a specific sanitary sewer interceptor or portion thereof is shut down for any reason. The bypass system must be capable of overcoming any pressure in the Owner's existing force main, if applicable, into which it discharges.

6. Discharge location for each bypass pumping operation shall be an appropriate manhole, structure, pipeline, vehicle, or container, provided that the Contractor

demonstrates that the existing manhole, structure, pipeline, vehicle, or container has the capacity to accept or transfer the flow. All discharge locations shall be approved by the Owner and/or Engineer. Under no circumstances shall the fluid or solids being bypassed be discharged, stored, or deposited into the open environment, including, but not limited to, on the ground, on roadways, into creeks, and/or into storm sewers.

7. Discharge piping shall be constructed of ductile iron, polyethylene, or Acrylonitrile-Butadiene-Styrene (ABS) pipe with positive, restrained joints. All pipe materials utilized in temporary bypass pumping during construction shall be in good condition and shall be free of defects and leaks; any defective material shall be replaced by the Contractor at no cost to the Owner and Engineer. Under no circumstances will aluminum "irrigation" type piping or glued PVC pipe be allowed. Discharge hose shall only be allowed in short sections if specifically approved by the Owner and/or Engineer.

    a. Ductile iron pipe shall be in accordance with Section 40 27 01 – Ductile Iron Pipe.

    b. Polyethylene pipe shall be in accordance with Section 40 27 02 – High Density Polyethylene (HDPE) Pipe.

    c. ABS pipe shall comply with the requirements of ASTM D2751.

8. Contractor shall provide a separate control panel for each pump.

9. Contractor shall provide pressure and vacuum gauges on the bypass pumping system suction and discharge headers.

10. Contractor shall provide pressure switches to start and stop the pumps.

11. Minimum requirements for flow and head for each location are as below:

    a. Jefferson Metropolitan – 150 GPM at 21 Feet TDH.

    b. Coleman Lakes – 220 GPM at 125 Feet TDH.

    c. McAdory – 200 GPM at 168 Feet TDH.

PART 3 -- EXECUTION

3.01 PREPARATION

A. The Contractor shall be responsible for locating all existing utilities in the area where the Contractor selects to locate the bypass pumps and pipelines, including locating the Owner's existing discharge force main, if applicable, for connection to the bypass piping. The Contractor shall locate his bypass pipelines to minimize any disturbance to existing utilities

and shall obtain approval of the pipeline locations from the Owner and/or Engineer.

B. During all bypass pumping operations, the Contractor shall protect the bypass pumps, bypass pipelines, discharge pipeline or structure, and influent pipeline or structure from damage inflicted by any equipment. The Contractor shall be responsible for all physical damage to the temporary pumping system or sanitary sewer interceptors caused by human or mechanical failure.

C. Contractor shall keep spare parts for pumps and piping onsite as required. Contractor shall maintain adequate hoisting equipment for each pump and accessories on-site.

3.02 INSTALLATION AND REMOVAL

A. The Contractor shall pipe sections or make connections to the existing pipelines or structures and construct temporary bypass pumping structures only at the access location and as may be required to provide an adequate suction conduit.

B. Each temporary bypass pumping system shall be tested before placing the system in operation. Testing periods shall occur only between the hours of 8:30 a.m. and 3:00 p.m., Monday through Wednesday. Testing of bypass pumping system shall NOT be allowed Thursday through Sunday, on the Owner or Engineer's scheduled Holidays, or on the day immediately prior to an Owner or Engineer's scheduled Holiday. In addition, testing of bypass pumping system shall only be performed during the Owner and Engineer's normally scheduled work days. Testing shall include leakage testing, pressure testing, and operational testing.

1. Leakage and Pressure Test: Contractor shall perform leakage and pressure testing for a minimum of two (2) hours on the pump suction piping and discharge piping in accordance with Article 3.03, Paragraph A.

2. Operational Test: Contractor shall operate the temporary bypass pumping system for as long as necessary to demonstrate reliable operation of the entire system, including but not limited to pumps, controls, and alarms, to the satisfaction of the Owner and/or Engineer prior to beginning any work in the area which is being bypassed.

C. Plugging or blocking of wastewater flows shall incorporate primary and secondary plugging devices. Plugging devices shall be designed so that all or any portion of the plugged flow can be released. When plugging or blocking is no longer needed for performance of the Work or portions thereof, the plugs shall be removed in a manner that permits the wastewater flow to slowly return to normal without surge, surcharging, or causing other major disturbances downstream.

D. The installation of the bypass pipelines is prohibited in all saltmarsh/wetland areas. The temporary bypass pumps and pipeline must be located off existing roadways as much as practicable. If the bypass pipelines cross a roadway, the Contractor shall place the bypass pipelines in trenches and cover them with temporary pavement. Contractor shall take appropriate steps to ensure that all pumps, piping, and hoses that carry raw wastewater are protected from traffic, and all required traffic control shall be performed in accordance with

the requirements of Section 01570 – Traffic Regulation. At all times during all bypass pumping operations, Contractor shall maintain access for Owner's personnel to the entirety of the sanitary sewer system and portions thereof, in accordance with Section 01530 – Protection of Existing Facilities.

E. At the conclusion of a specific bypass pumping operation and when all of the modifications to the specific sanitary sewer interceptor are complete, tested, and ready for operation, Contractor shall demonstrate the new equipment or system for a duration of time as approved by the Owner and/or Engineer. At the completion of the demonstration period and once written permission is granted by the Owner and/or Engineer, Contractor shall remove all temporary bypass components, restore all pavement, and restore the area around the specific sanitary sewer interceptor and temporary bypass pumping system to original pre-construction conditions to the satisfaction of the Owner and Engineer.

1. At a specific bypass pumping operation, Contractor may stop operation of the bypass pumping system during times and days that are not included in the normal time of work as specified in Section 01015 – Prosecution and Progress. Prior to stopping operation of the bypass pumping system, Contractor shall demonstrate to the satisfaction of the Owner or Engineer that the connections between the existing sanitary sewer interceptor and/or manholes and newly-installed sanitary sewer interceptor and/or manholes are watertight with no leakage and that there is no debris in the sanitary sewer interceptor and manholes that would impede wastewater flow prior to de-energizing the bypass pumping system.

3.03 QUALITY CONTROL AND MAINTENANCE

A. Testing: Contractor shall perform leakage and pressure tests on the bypass pump suction and discharge piping using clean water prior to actual operation. Pressure tests shall be conducted at a test pressure equivalent to 150 percent of the design pressure. The Owner and/or Engineer shall be given 24 hours notice prior to testing.

B. Inspection: After installation, the bypass piping shall be inspected and approved by the Owner and/or Engineer prior to beginning any work on the sewer section which is being bypassed. For the entire duration that any specific bypass pumping system is in operation, Contractor shall continuously monitor onsite the bypass pumping system to ensure that the system is correctly working and shall keep a written log of the pump inspection results.

C. Maintenance/Monitoring: Contractor shall ensure that the bypass pumping system is properly maintained. Bypass pumping system shall be continuously manned and monitored by a responsible and competent mechanic/operator who is capable of starting, stopping, refueling, and maintaining the pumps at all times that the system is in operation.

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DIVISION 40

PROCESS INTEGRATION

SECTION 40 05 15
PIPING SUPPORT SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Civil Engineers (ASCE): 7, Minimum Design Loads for Buildings and Other Structures.
2. American Society of Mechanical Engineers (ASME): B31.1, Power Piping.
3. ASTM International (ASTM):
   a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   b. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
   c. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
4. International Code Council (ICC):
   a. International Building Code (IBC).
   b. International Mechanical Code (IMC).
5. Manufacturers' Standardization Society (MSS):
   a. SP 58, Pipe Hangers and Supports - Materials, Design and Manufacture.
   b. SP 69, Pipe Hangers and Supports - Selection and Application.
   c. SP 89, Pipe Hangers and Supports - Fabrication and Installation Practices.
   d. SP 127, Bracing for piping Systems, Seismic-Wind-Dynamic Design, Selection and Application.

1.02 SUBMITTALS

A. Action Submittals:

1. Catalog information, design calculations, and Drawings of piping support system, locating each support, and anchor. Identify support, and anchor type by catalog number and Shop Drawing detail number.
2. Revisions to support systems resulting from changes in related piping system layout or addition of flexible joints.
3. Maintenance information on piping support system.

1.03 DESIGN REQUIREMENTS

A. General:

1. Design, size, and locate piping support systems throughout facility, whether shown or not.
2. Supports are shown only where specific types and locations are required; additional pipe supports may be required. Designer may propose an alternate support to that shown for approval.
3. Meet requirements of MSS SP 58, MSS SP 69, MSS SP 89, and ASME B31.1 or as modified by this section.

B. Pipe Support Systems: Pipe support systems shall be designed for gravity and thrust loads imposed by weight of pipes or internal pressures, thermal expansion and wind loads including weight of fluid in pipes and insulation.

C. Anchoring Devices: Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor support, to withstand shear and pullout loads imposed by loading and spacing on each particular support.

PART 2 PRODUCTS

2.01 GENERAL

A. When specified items are not available, fabricate pipe supports of correct material and to general configuration indicated.

B. Special support and hanger details may be required for cases where standard catalog supports are inapplicable.

C. Materials: Supports shall be of all Type 304 stainless steel construction.

D. Saddle Supports:

1. Pedestal Type: Schedule 40 pipe stanchion, saddle, and anchoring flange.
    a. Nonadjustable Saddle: MSS SP 58 and MSS SP 69, Type 37 with U-bolt.
        1) Anvil; Figure 259, sizes 4 inches through 36 inches with Figure 62C base.
        2) B-Line; Figure B3090, sizes 3/4 inches through 36 inches with B3088 base.
        3) Approved equal.
2. Elbow and Flange Supports:
    a. Elbow with Nonadjustable Stanchion:
        1) Sizes 2-1/2 inches through 42 inches.
            a) Anvil; Figure 63C base.
            b) Approved equal.

b. Flange Support with Adjustable Base:
    1) Sizes 2 inches through 24 inches.
        a) B-Line; B3094, with Figure B3088T base.
        b) Standon; Model S89.
        c) Approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. Install support systems in accordance as detailed by the manufacturer.
2. Support piping connections to equipment by pipe support and not by equipment.
3. Support all valves, fittings, and appurtenances independently of connected piping.
4. Support no pipe from pipe above it.
5. Support pipe at changes in direction or in elevation, adjacent to flexible joints and couplings, and where shown.
6. Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.
7. Repair mounting surfaces to original condition after attachments are made.

END OF SECTION

SECTION 40 23 46
FABRICATED SLIDE AND SLUICE GATES

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. This section includes the Work necessary to furnish and completely install, adjust, protect, put in operation, and test fabricated slide gates as shown on the Drawings and as specified herein.

1.2 GENERAL

A. Equipment Numbers: See supplemental data sheet(s) at end of section.

B. Like items of equipment provided hereinafter shall be the end products of one manufacturer to achieve standardization of appearance, operation, maintenance, spare parts, and manufacturer's services.

C. Unit Responsibility: The Work requires that the mixer, complete with all accessories and appurtenances (including, but not necessarily limited to, electric motors, baffles, and components), be the end product of one responsible system manufacturer or responsible system supplier. Unless otherwise indicated, the Contractor shall obtain each system from the responsible supplier of the equipment, which supplier shall furnish all components and accessories of the system to enhance compatibility, ease of operation and maintenance, and as necessary to place the equipment in operation in conformance with the specified performance, features and functions without altering or modifying the Contractor's responsibilities under the Contract Documents. The Contractor is responsible to the Owner for providing the equipment systems as specified herein.

D. General Requirements: See Division. 01, GENERAL REQUIREMENTS, which contains information and requirements that apply to the work specified herein and are mandatory for this project.

E. The equipment specified herein is included in the MANUFACTURER/ SUBCONTRACTOR Form. Refer to the Bid Form and the Instructions to Bidders for additional requirements.

1.3 DEFINITIONS

A. Submersible: The ability to exclude water when submerged under a 20-foot head of fresh water for 24 hours and still maintain electrical integrity.

B. Slenderness Ratio: The ratio of the maximum unsupported stem length to the stem cross-section radius of gyration.

C. Self-Contained: The arrangement of the gate operator, supported by the gate frame, such that operating thrust loads are not applied external to the assembly.

1.4 SYSTEM COORDINATION

A. Coordinate gate dimensional requirements with concrete formwork and reinforcing details where gates are to be embedded in concrete walls and floor slabs.

1.5 SUBMITTALS

A. Submittals shall be made as required in Section 01 33 00, SUBMITTALS of Division 01, GENERAL REQUIREMENTS.

B. In addition to the requirements of Section 01 33 00, SUBMITTALS, submit the following additional specific information:
   1. Shop Drawings:
      a. Make, model, weight, and horsepower of each equipment assembly.
      b. Manufacturer's catalog information, descriptive literature, specifications, and identification of materials of construction.
      c. Detailed structural, mechanical, and electrical drawings showing the equipment fabrications and interface with other items. Include dimensions, size, and locations of connections to other work, and weights of associated equipment associated therewith.
      d. Gate operator and stem calculations for each gate and service condition.
      e. Gate opening and closing thrust forces that will be transmitted to the support structure with operator at extreme positions and load.
      f. External utility requirements such as air, water, power, drain, etc., for each component.
      g. Power and control wiring diagrams, including terminals and numbers and nameplate information for portable electric drill.
      h. Performance Test Procedures.
   2. Quality Control Submittals:
      a. Factory Functional Test Reports.
      b. Manufacturer's certification of compliance that the factory finish system is identical to the requirements specified herein.
      c. Special shipping, storage and protection, handling instructions.
      d. Manufacturer's printed installation instructions.
      e. Manufacturer's Certificate of Proper Installation.
      f. Suggested spare parts lists to maintain the equipment in service for a period of 1 year and 5 years. Include a list of special tools required for checking, testing, parts replacement and maintenance.
      g. List of special tools, materials and supplies furnished with equipment for use prior to and during startup and for future maintenance.
      h. Field test logs.
      i. Instrumentation and control submittals as listed in Division 26, ELECTRICAL.
   3. Contract Closeout Submittals: Service records for maintenance performed during construction.

1.6 OPERATION AND MAINTENANCE DATA

A. O&M Manuals: Content, form, and schedule for providing as specified in Section 01 78 23, OPERATION AND MAINTENANCE DATA.

B. Maintenance Summary Forms: As specified in Section 01 78 23, OPERATION AND MAINTENANCE DATA.

1.7 WARRANTY

A. Provide warranty for a period of 12 months after the final acceptance of the equipment by the Owner and Engineer. The warranty shall stipulate that the equipment furnished is suitable for the purpose intended and free from defects of material and workmanship for the duration of the warranty. In the event the equipment fails to perform as specified, the Manufacturer will promptly repair or replace the defective equipment without additional cost to the Owner.

B. Spare parts identified within this specification shall not be used to address warranty repairs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Where a Manufacturer's standard equipment name and/or model number is listed, the equipment system shall be provided as modified to conform to the performance, functions, features, and materials of construction as specified herein.

B. Manufacturers of components and accessories specified herein shall be as follows:
1. HydroGate Corp.
2. Rodney Hunt Co.
3. Fontaine-Aquanox
4. WACO Products, Inc.
5. Waterman Industries, Inc.

2.2 GATE TYPES

A. Rising stem type, with assembly styles designated as follows:
1. Style A: Upward acting slide gate type for mounting in channels with concrete embedded invert.
2. Style B: Downward acting slide gate type with P-type invert seal for wall surface mounting on concrete structures.
3. Style C: Downward acting slide gate weir type with P-type invert seal for wall surface mounting on concrete structures.
4. Style D: Upward acting sluice gate type for wall surface mounting on concrete structures.
5. Style E: Upward acting stop gate type for mounting in channels with concrete embedded invert.

2.3 PERFORMANCE REQUIREMENTS

A. Leakage shall not exceed 0.1 gallon per minute per foot of gate periphery under either seating or unseating head conditions.

2.4 SLIDE GATES

A. Materials
   1. Aluminum Plate and Shapes: ASTM B209 and B308, Alloy 6061-T6.
   2. Stainless Steel:
      a. Plate, Sheet, and Strip: ASTM A240, Type 304L.
      b. Bars and Shapes: ASTM A276, Type 304L.

B. Construction
   1. Guide Frames:
      a. Stainless steel.
      b. All gate frames shall be self-contained unless explicitly stated otherwise on drawings and/or on Gate Schedule.
      c. Vertical Guides: Design for maximum rigidity, and extend in one continuous piece from the gate invert to form posts for support of gate operators. When guides extended above the operating floor, they shall be sufficiently strong so that no further reinforcements are required.
         1) Weight: Not less than 9 pounds per linear foot for stainless steel.
         2) Incorporate a replaceable UHMW polyethylene bearing strip in a retainer slot on the downstream side (unseating head side) of the gate.
      d. Join vertical guide frames and invert with factory welded comers.
      e. Size guided slot to provide a minimum disc engagement of 1” on each side.

C. Disc:
   1. Disc Plate (Sliding Member): One-piece aluminum. Reinforce as required so that the disc will not deflect more than 1/360 of the gate span, when the upstream liquid depth (seating head side) is as shown on the schedule and the downstream liquid depth is less than ½”.
   2. Reinforce gate disc with one-piece aluminum angles or channels welded to the disc plate. Bolted reinforcements will not be permitted.
   3. Where required on the Drawings, furnish V-notch or rectangular weir cutouts in the disc plate and cutout dimensions and location to match details shown on the Drawings.

D. Operator Support Yoke:
   1. Attach to the vertical extensions of the guide frames.
   2. Constructed from at least two aluminum or stainless steel angles, or two other suitable shapes, and bolt in place to provide a rigid assembly.
   3. Maximum Deflection: Not to exceed ¼” under full operator applied loading.

E. Stems:
   1. 1” minimum diameter, ASTM A276, Type 304 stainless steel.

2. Threads: ACME type with RMS surface roughness of 63 micro-inches or less on the flanks for manually operated gates and 32 micro-inches or less on the flanks for electrically operated gates. Extend threaded portion of stem 2" above operator when gate is in CLOSED position.
3. Slenderness ratio shall not exceed 200.
4. Stems to withstand in compression, without damage, the thrust equal to at least 250% of the rated output of the hoisting mechanism, with a 40-pound effort applied to the hand wheel or crank.
5. Cast iron bushed stem guides, mounted on cast iron brackets; adjustable in two directions and spaced so that the slenderness ratio does not exceed 200.
6. Adjustable stop collar for the CLOSED position.
7. Connect the stems to the disc plate with a yoke, bolted to the stem and welded to the disc.
8. Slide gates having a width greater than twice the height or width greater than 84" shall have dual stems.
9. For downward opening weir type gates, locate stems near outside edges of gate.

F. Stem Covers:
1. Transparent plastic, vented pipe stem cover and cap.
2. Provide with OPEN/CLOSED designators with 1" graduations on Mylar pressure sensitive, adhesive tape, suitable for outdoor application.

G. Gate Operators
1. Motorized Operators:
a. See Section 40 92 13
2. Hand wheel-Operated Bench Stands:
a. Sealed, ball-thrust, roller or needle bearing type and equipped with bronze lift nut, internally threaded with Acme threads.
b. Furnish mechanical seals at housing penetrations.
c. Hand wheel and Baseplate: Cast iron or cast aluminum.
d. Manual Effort: Not to exceed 40 pounds.
3. Identification Tagging Requirements:
a. For each gate operator, l-1/2" minimum diameter heavy brass tag, and bearing the gate tag number shown in the Gate Schedule.
b. Attach the tags to the operator by soldered split key rings such that ring and tag cannot be removed. Use block type numbers and letters with ¼" minimum height. Numbers and letters shall be stamped on and filled with black enamel.

2.5 SLUICE GATES

A. General:
1. Unless otherwise specified, conform to AWWA C501, rising stem type.
2. Minimum Acceptable Casting Thickness for Cast Iron Components: 3/4".
3. Gates shall open to the full dimension of the opening as indicated in the Gate Schedule.

B. Wall Thimbles:
   1. Cast-iron, one-piece construction, in accordance with ASTM A126, Class B.
   2. Cast center ring or water stop around periphery.
   3. Front Flange: Machined, with tapped holes for sluice gate frame attaching studs.
   4. Stamp vertical center lines of metal with word "top."
   5. Furnish permanent gasket of uniform thickness or mastic between sluice gate frame and thimble.
   6. Coordinate with sluice gate manufacturer as necessary for required bolt-hole size and pattern for connection to sluice gate thimbles.

C. Frames:
   1. Cast iron one-piece construction, in accordance with ASTM A126, Class B.
   2. Unless specifically noted otherwise, all gates shall be furnished with self-contained frames.
   3. Machine contact surfaces.
      a. Machine dovetailed grooves on front face, into which seat facings shall be driven and machined.
      b. Machine back flange to bolt directly to machined-face of wall thimble cast in concrete.
   4. For frames with top and bottom wedges, furnish integrally cast pads machined with keyways to receive wedge seats.
   5. Where side clearance is limited, flanged frames may require mounting holes to be drilled through to front face of frame.

D. Discs:
   1. Cast iron, one-piece construction with integrally cast vertical and horizontal ribs in accordance with ASTM A126 Class B.
   2. Machine dovetailed grooves on seating face, into which seat facings shall be driven and machined.
   3. Wedge Pads: Integrally cast on disc and machined to receive adjustable wedges.
   4. Cast a heavily reinforced nut pocket integrally on vertical centerline above horizontal centerline to receive thrust nut.

E. Guides:
   1. Cast iron, one-piece, in accordance with ASTM A126 Class B designed to withstand total thrust from water pressure and wedging action.
   2. Machine contact surfaces.
   3. Length: Sufficient to retain and support disc in fully OPEN position.
   4. Attach to frame with ASTM A167, Type 304 stainless steel studs; dowel to prevent relative motion between guides and frame or cast guides integrally with frame.
   5. Securely attach wedge seats to machined pads on guides.
   6. Maximum spacing between guides shall be no more than 8 feet.

F. Wedges and Seat Facings:
   1. Side wedges for all conditions. Top and bottom wedges for unseating heads as necessary to meet leakage requirements.
   2. Solid cast ASTM B584, Alloy 865 manganese bronze.

3. Machine contact surfaces and key, to cast iron pads, to prevent rotation or lateral motion.
4. Attach wedges to disc with AISI Type 304 stainless steel studs and nuts.
5. Seat Facings: ASTM B21, Alloy B, shaped to fill and permanently lock in machined dovetail grooves when pneumatically impacted into place. Attaching pins and screws not permitted.

G. Stems:
1. 1" minimum diameter, ASTM A276, Type 304 stainless steel.
2. Threads: Acme type with RMS surface roughness of 63 micro-inches or less on flanks for manually operated gates and 32 micro-inches or less on flanks for electrically operated gates. Extend threaded portion of stem 2" above operator when gate is in CLOSED position.
3. Couplings:
   a. Use when stems have more than one section.
   b. Same material as stem.
   c. Furnish with internal threads that transmit full thrust of stem.
   d. Hold in place on stem with bolts or keys and keyways.
   e. Same size and interchangeable.
4. Slenderness ratio shall not exceed 200.
5. Withstand in compression, without damage, thrust equal to at least 250% of rated output of hoisting mechanism, with a 40-pound effort applied to hand wheel or crank.
6. Cast iron, bushed stem guides, mounted on cast iron brackets, adjustable in two directions and spaced so that slenderness ratio does not exceed 200.
7. Adjustable stop collar for CLOSED position.

H. Stem Covers:
1. Transparent plastic, vented pipe stem cover and cap.
2. Provide with OPEN/CLOSED designators with 1" graduations on Mylar pressure sensitive, adhesive tape, suitable for outdoor application.

I. Flush-Bottom Closure Seals:
1. Compressible Resilient Seal:
   a. Attached to bottom of disc with a bronze or stainless steel bar and bronze or stainless steel fasteners.
   b. Specially molded shape designed to fit a lip machined on bottom rib of disc.
   c. Shaped to produce a wide sealing area on a machined cast iron stop bar, bolted and keyed to gate frame to form a flush invert.
   d. Differential sealing pressure of resilient seal on stop bar shall be variable by adjustment of side wedges on gate.
2. Alternative Closures:
   a. Solid, square-cornered, resilient rubber seal in place of bottom dovetail facing and wedging devices.
   b. Securely fastened to bottom cross member of frame on a stop plate, with a retainer and stainless steel fasteners.
   c. Make top surface of seal flush with invert of gate opening.

d. Machine full length of bottom edge of disc accurately to make contact with seal when disc is closed.

J. Operators
1. General:
a. Components: Withstand a minimum of 250% of design torque or thrust at extreme operator positions without damage.
b. Sizing: Include hydraulic down-pull load for heads greater than 30’ and for nominal gate widths greater than 5’.
c. Gear train and gate stem sections shall produce a self-locking drive train.
d. Lift Nuts: Internally threaded with cut or cold-rolled Acme threads corresponding to stem threading.
e. Roller Bearings: Ball-thrust or tapered above and below lift nut to support both opening and closing thrusts.
1) Grease lubrication fittings for bearings.
2) Input pinions with needle or ball bearings.
f. Lubrication: Furnish rising stem gates with an insert lubricator flange in lift, with grease fitting for greasing stem threads below stem nut.
2. Type 1, Manual, Hand wheel-Operated Floor Stands:
a. Manual Effort: Not to exceed 40 pounds.
b. Hand wheel: Directly drive a replaceable bronze stem nut for a rising gate stem, bearing mounted on a cast iron pedestal and base.
3. Identification Tagging Requirements:
a. For each gate operator, 1-1/2” minimum diameter heavy brass tag, bearing gate tag number shown in schedule.
b. Attach tags to operator by soldered split key rings so that ring and tag cannot be removed. Use block type numbers and letters with ¼” minimum high numbers and letters stamped on and filled with black enamel.

2.6 STOP GATES

A. Materials
1. Aluminum Plate and Shapes: ASTM B209 and B308, Alloy 6061-T6.
2. Stainless Steel:
a. Plate, Sheet, and Strip: ASTM A240, Type 304L.
b. Bars and Shapes: ASTM A276, Type 304L.

B. Construction
1. Guides:
a. Stainless steel.
b. All gate guides shall be embedded in concrete as shown on the Drawings.
c. Vertical Guides: Design for maximum rigidity, and extend in one continuous piece from the gate invert to top of wall or operating floor. Guides shall not extend above the operating floor.
1) Weight: Not less than 9 pounds per linear foot for stainless steel.
2) Incorporate a replaceable UHMW polyethylene bearing strip in a retainer slot on the downstream side (unseating head side) of the gate.

d. Join vertical guide frames and invert with factory welded comers.
e. Size guide slot to provide a minimum disc engagement of 1” on each side.

C. Disc:
1. Disc Plate (Sliding Member): One-piece aluminum. Provide hand hole for manual removal of gate. Reinforce as required so that the disc will not deflect more than 1/360 of the gate span, when the upstream liquid depth (seating head side) is as shown on the schedule and the downstream liquid depth is less than ½”.
2. Reinforce gate disc with one-piece aluminum angles or channels welded to the disc plate. Bolted reinforcements will not be permitted.
3. Where required on the Drawings, furnish V-notch or rectangular weir cutouts in the disc plate and cutout dimensions and location to match details shown on the Drawings.

2.7 ACCESSORIES

A. Lifting Lugs: Equipment weighing over 100 pounds shall be provided with lifting lugs.

B. Anchor Bolts: ASTM A193, Type 316 stainless steel, sized by equipment Manufacturer at least 1/2” in diameter, or as shown, and as specified in Section 05 50 00, METAL FABRICATIONS.

C. Staff Gauges: For all downward acting Weir Gates. Graduated in 1/4” and marked every inch and foot.

D. Extension Bonnet for Gate Operator: Complete with stem and accessories for gate and operator.

E. Floor Box and Stem:
1. Plain type, for support of non-rising type stem.
2. Complete with stem, operating nut, and stem guides brackets.
3. Stem Guides: Space such that slenderness ratio does not exceed 200.
4. Anchor Bolts: Type 316 stainless steel.

F. Painting: Coat all aluminum surfaces in contact with concrete with un-thinned Bitumastic paint or insulate with suitable protective neoprene gasket material.

2.8 TOOLS AND SPARE PARTS

A. Tools: The work includes furnishing two complete set of special tools recommended by the manufacturer for maintenance and repair of each separate type of equipment; tools shall be stored in tool boxes and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the box.

B. Spare parts shall be tagged by project equipment number and identified as to part number, equipment manufacturer and subassembly component (if appropriate). Spare parts subject to deterioration such as ferrous metal items and electrical components shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic

wrapping. Spare parts with individual weights less than 50 pounds and dimensions less than 2 feet wide, or 18 inches high, or 3 feet in length shall be stored in a wooden box with hinged wooden cover and locking clasp. Hinges shall be strap type. The box shall be painted and identified with stenciled lettering stating the name of the equipment, equipment numbers, and the words "spare parts." A neatly typed inventory of spare parts shall be taped to the underside of the cover.

C. At a minimum provide the following:

Item	Quantity
Stem collars for gate stems	1 of each different size
Bronze lift nuts	1 of each different size
Special tools required to maintain or dismantle	1 complete set

2.9 FABRICATION

A. Shop/Factory Finishing: Shop prime and finish coatings shall be as required in Section 09 90 00, PAINTING AND PROTECTIVE COATINGS, System No. 2. Coordinate color with Owner.

PART 3 - EXECUTION

3.1 ASSEMBLY AND PREPARATION FOR SHIPMENT

A. Each drive unit, including motor, shall be completely factory assembled, aligned, and securely crated for shipment. Accessory equipment which cannot be shipped assembled to the unit, such as shafts, baseplates, impellers, spare parts, and anchorage materials, shall' be separately crated, clearly marked as to the contents, and shipped on the same shipment as the drives.

B. For shipment, exposed surfaces subject to rust, such as mounting flange faces, etc., shall be covered with a rust-preventive compound such as Kendall No. 5, or equal.

3.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 60 00, PRODUCT REQUIREMENTS.

B. Delivery of Materials: Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

C. Storage: Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

D. Protection of Equipment: Equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times.

Pumps, motors, drives, electrical equipment, and other equipment with anti-friction or sleeve bearings shall be stored in weather tight and heated storage facilities prior to installation. For extended storage periods, plastic equipment wrappers shall not be used to prevent accumulation of condensate in gears and bearings.

3.3 INSTALLATION

A. In strict accordance with the Manufacturer's written instructions and recommendations in the locations shown on the Drawings and the Gate Schedule.

B. Disassemble factory assembled gate components before installation.

C. After installing gates, the operators will be field mounted.

D. Brace thimbles internally during concrete placement.

E. Accurately place anchor bolts using templates furnished by the Manufacturer and as specified in Section 05 50 00, METAL FABRICATIONS.

F. Lubricate stems before operating.

G. Extension Stem for Operator: Furnish, as required by the Drawings, an operating extension stem with 2" operating nut to bring the operating nut to a point 6" below the surface of the ground and/or box cover.

H. Floor Box and Stem: Steel extension stem length shall locate operating nut in the floor box.

3.4 QUALITY CONTROL

A. Functional Test: Prior to plant start-up, ensure proper movement of all slide gates and operators.

B. Performance Test: Perform under actual or approved simulated operating conditions, and test for a continuous 3-hour period without malfunction. Adjust, realign, or modify units and retest if necessary.

3.5 MANUFACTURER'S SERVICES

A. A manufacturer's representative for the equipment specified herein shall be present at the job site for the minimum person-days listed for the services hereinunder, travel time excluded:
   1. Installation, Startup and Testing Services:
      a. 1 person day for installation assistance, inspection and Certificate of Proper Installation.
      b. 1/2 person-day for functional and performance testing.
      c. Provide qualifications of Manufacturer's Representative.
   2. Training Services:

a. 1 person-day of prestart classroom or jobsite training of Owner's personnel.
b. Training of Owner's personnel shall be at such times and at such locations as required and approved by the Owner.

B. See Section 01 79 00, DEMONSTRATION AND TRAINING, of Division 01, GENERAL REQUIREMENTS.

3.6 MANUFACTURER'S CERTIFICATE(S)

A. Provide Manufacturer's certificate(s) in accordance with Section 01 79 06, DEMONSTRATION AND TRAINING, of Division 01, GENERAL REQUIREMENTS.

3.7 SUPPLEMENTS

A. The supplement listed below, following "END OF SECTION," is a part of this Specification.
1. Fabricated Slide / Sluice Gate Schedule.

END OF SECTION

Fabricated Slide and Sluice Gate Schedule							
Number of Gates	Assembly Style	Nominal Gate Opening (inches)	Opening Invert Elevation (feet)	Weir Cutout Width/Height (inches)	Weir Max/Min Invert Elevation (feet)	Design Operating Head Seating/Unseating Condition (feet)	Comments
1	D	24-in	Refer to Drawings	N/A	N/A	20 ft	

General Notes:

1. Refer to Drawing for structure finished floor and top of structure.
2. Invert elevation is bottom of gate in most closed position.
3. For weir type gates, invert elevation is top of weir most closed position.
4. For Style D Gates, nominal pipe diameter shown.

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SECTION 40 27 00
FORCE MAIN PIPING—GENERAL

PART 1 GENERAL

1.01 DESIGN REQUIREMENTS

A. Buried Piping: H20-S16 traffic load with 1.5 impact factor, AASHTO HB-17, as applicable.

1.02 DELIVERY, STORAGE, AND HANDLING

A. Flanges: Securely attach metal, hardboard, or wood protectors over entire gasket surface.

B. Threaded or Socket Welding Ends: Fit with metal, wood, or plastic plugs or caps.

C. Linings and Coatings: Prevent excessive drying.

D. Cold Weather Storage: Locate products to prevent coating from freezing to ground.

E. Handling: Use heavy canvas or nylon slings to lift pipe and fittings.

PART 2 PRODUCTS

2.01 PIPING

A. As specified on Piping Data Sheet(s) and Piping Schedule located at the end of this section as Supplement.

B. Installation Location Requirements:

1. All suction piping and discharge piping within wet well (where applicable based upon the pump type, through valve vault, self-regulating automatic valve(s) vault and to the pump station property line unless otherwise approved by the ESD shall be Ductile Iron.
2. Force main from the pump station to the discharge site shall be ductile iron or high-density polyethylene pipe (HDPE).

C. Diameters Shown:

1. Standardized Products: Nominal size.

2.02 DUCTILE IRON JOINTS

A. Flanged Joints:

1. Flat-faced, carbon steel, or alloy flanges when mating with flat-faced flanges.
2. Higher pressure rated flanges as required to mate with equipment when equipment flange is of higher pressure rating than required for piping.

B. Mechanical Joint Anchor Gland Follower:

1. Ductile iron anchor type, wedge action, with break-off tightening bolts.
2. Thrust rated to 250 psi minimum.
3. Rated operating deflection not less than:
   a. 3 degrees for sizes through 12 inches.
   b. 2 degrees for sizes 14 inches through 16 inches.
   c. 1.5 degrees for sizes 18 inches through 24 inches.
4. Manufacturer: Ebaa.

C. Buried Service:

1. Restrained: Manufacturer's proprietary system. Locking gaskets shall for ductile iron shall only be used where approved by the Owner/Owner's Representative.
2. Unrestrained: Manufacturer's standard bell and gasket push on joint.

2.03 HDPE JOINTS

A. Thermal butt –fusion of same rating as pipe.

B. Thermally butt fused to end of pipe. Install with backup rings of Type 316 stainless steel.

2.04 GASKET LUBRICANT

A. Lubricant shall be supplied by pipe manufacturer and no substitute or "or-equal" will be allowed.

2.05 FABRICATION

A. Mark each pipe length on outside with the following:

1. Size or diameter and class.
2. Manufacturer's identification and pipe serial number.
3. Location number on laying drawing.
4. Date of manufacture.

B. Code markings according to approved Shop Drawings.

2.06 FINISHES

A. Factory prepare, prime, and finish coat in accordance with requirements of the Drawings or where otherwise specified.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify size, material, joint types, elevation, horizontal location, and pipe service of existing pipelines to be connected to new pipelines or new equipment.

3.02 PREPARATION

A. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.

3.03 INSTALLATION—GENERAL

A. Join pipe and fittings in accordance with manufacturer's instructions, unless otherwise shown or specified.

B. Remove foreign objects prior to assembly and installation.

C. Flanged Joints:

1. Install perpendicular to pipe centerline.
2. Bolt Holes: Straddle vertical centerlines, aligned with connecting equipment flanges or as shown.
3. Use torque-limiting wrenches to ensure uniform bearing and proper bolt tightness.
4. Plastic Flanges: Install annular ring filler gasket at joints of raised-face flange.
5. Grooved Joint Flange Adapters: Include stainless steel washer plates as required for mating to serrated faces and lined valves and equipment.
6. Raised-Face Flanges: Use flat-face flange when joining with flat-faced flange.
7. Verify compatibility of mating flange to adapter flange gasket prior to selecting grooved adapter flanging.
8. Flange fillers are to be avoided, but if necessary, may be used to make up for small angles up to 6 degrees and for filling gaps up to 2 inches between flanges. Stacked flange fillers shall not be used.
9. Threaded flanged joints shall be shop fabricated and delivered to Site with flanges in-place and properly faced.
10. Manufacturer: Same as pipe manufacturer.

D. Threaded and Coupled Joints:

1. Conform to ASME B1.20.1.

2. Produce sufficient thread length to ensure full engagement when screwed home in fittings.
3. Countersink pipe ends, ream and clean chips and burrs after threading.
4. Make connections with not more than three threads exposed.
5. Lubricate male threads only with thread lubricant or tape as specified on Piping Data Sheets.

3.04 INSTALLATION—EXPOSED PIPING

A. Piping Runs:

1. Parallel to building or column lines and perpendicular to floor, unless shown otherwise.
2. Piping upstream and downstream of flow measuring devices shall provide straight lengths as required for accurate flow measurement.

B. Supports: As specified in Section 40 05 15, Piping Support Systems.

C. Connectors:

1. Dismantling Fittings: As specified in Section 40 27 10, Piping Specialties.

D. Flanges:

1. Provide at each piping connection to equipment or instrumentation on equipment side of each block valve to facilitate installation and removal.
2. Where required and approved to allow field cutting of pipe, use Flange Adaptors as specified in Section 40 27 10, Piping Specialties.

E. Install piping so that no load or movement in excess of that stipulated by equipment manufacturer will be imposed upon equipment connection; install to allow for contraction and expansion without stressing pipe, joints, or connected equipment. Where required utilize Expansion Connector as specified in Section 40 27 10, Piping Specialties.

F. Heat trace and insulate all exposed piping in accordance with Sections 40 42 13, Process Piping Insulation and 40 05 33, Pipe Heat Tracing.

3.05 INSTALLATION—BURIED PIPE

A. Placement:

1. Keep trench dry until pipe laying and joining are completed.
2. Pipe Base and Pipe Zone: As specified in Section 31 23 23, Trench Backfill.
3. Exercise care when lowering pipe into trench to prevent twisting or damage to pipe.

4. Measure for grade at pipe invert, not at top of pipe.
5. Excavate trench bottom and sides of ample dimensions to permit visual inspection and testing of entire flange, valve, or connection.
6. Prevent foreign material from entering pipe during placement.
7. Close and block open end of last laid pipe section when placement operations are not in progress and at close of day's work.
8. Lay pipe upgrade with bell ends pointing in direction of laying.
9. After joint has been made, check pipe alignment and grade.
10. Place sufficient pipe zone material to secure pipe from movement before next joint is installed.
11. Prevent uplift and floating of pipe prior to backfilling.
12. Provide restrained joints where required.

B. Tolerances:

1. Deflection from Horizontal Line: Maximum 2 inches.
2. Deflection From Vertical Grade: Maximum 1/4 inch.
3. Joint Deflection: Maximum of 25 percent of manufacturer's recommendation.
4. Horizontal position of pipe centerline on alignment around curves maximum variation of 1.75 feet from position shown.
5. Pipe Cover: Minimum 3 feet, unless otherwise shown.

3.06 THRUST RESTRAINT

A. Location: As detailed on the Drawings and approved by the Owner/Owner's Representative.

3.07 HDPE PIPE PLACEMENT

A. Lay pipe snaking from one side of trench to other.

B. Offset: As recommended by manufacturer for maximum temperature variation between time of solvent welding and during operation.

C. Do not lay pipe when temperature is below 40 degrees F, or above 90 degrees F when exposed to direct sunlight.

D. Shield ends to be joined from direct sunlight prior to and during the laying operation.

E. Install mid span restraints at transitions into structures and where it transitions to ductile iron to prevent the expansion/contraction forces from being transferred to the structure or transition fitting.

3.08 TOLERANCES

A. Deflection from Horizontal Line (Except HDPE): Maximum 2 inches.

B. Deflection From Vertical Grade: Maximum 1/4 inch.

C. Joint Deflection: Maximum of 75 percent of manufacturer's recommendation.

D. Horizontal position of pipe centerline on alignment around curves maximum variation of 1.75 feet from position shown.

E. Pipe Cover: Minimum 3 feet, unless otherwise shown.

3.09 FIELD FINISHING

A. Notify the ESD at least 3 days prior to start of any surface preparation or coating application work.

3.10 FIELD QUALITY CONTROL

A. Pressure Leakage Testing: As specified in Section 40 80 01, Piping Leakage Testing.

3.11 CLEANING

A. Following assembly and testing, and prior to final acceptance, flush pipelines (except as stated below) with water at 2.5 fps minimum flushing velocity until foreign matter is removed.

3.12 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification:

1. Pipe Data Sheets.

Number	Title
40 27 01	Ductile Iron Pipe and Fittings
40 27 02	High Density Polyethylene Pipe and Fittings

END OF SECTION

SECTION 40 27 01 DUCTILE IRON PIPE AND FITTINGS	
Item	**Description**
Pipe	AWWA C150/A21.50, AWWA C151/A21.51
Minimum Pressure Rating	12-inch and smaller - 350 psi 14-inch and larger – 250 psi unless otherwise shown on Drawings or specified.
Exterior Coating	Exposed: Primed for final coating at site. Top coating shall be a high build epoxy rated for wastewater expose with top coat to provide protection where exposed to the sun Buried: Polywrappped unless otherwise specified
Interior Lining	Permox CTF (White) or Approved Equal
Fittings	AWWA C110/A21.10. or ANSI/AWWA C153/A21.53
Joints	- Exposed: Flanged - Buried: Restrained Joint as Detailed using pipe manufacturer's proprietary joint restraint system
Field Cuts/Connection	EBAA Series 1100 or approved equal
Gaskets	Flanged: Toruseal or approved equal Buried: EPDM

END OF SECTION

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SECTION 40 27 02 HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS (HDPE)	
Item	**Description**
Pipe and Fitting	ASTM F714
Resin	Meet requirements of ASTM D3350 for PE 4710 with cell classification of 445474C. Pressure rating based upon hydrostatic design stress of 1000 psi at 73.4 degrees F.
Minimum Pressure Rating	200 psi (unless otherwise detailed on the Drawings).
Minimum DR Rating	DR 11 (unless otherwise detailed on the Drawings).
Thickness	Ductile Iron Pipe Size (unless otherwise detailed on the Drawings).
Fittings	Thermal butt –fusion of same rating as pipe.
Installation	Install in accordance with AWWA M55, PPI TR-33, ASTM F2620 and pipe manufacturer's recommendations.
Joining	Butt fuse. Provide data logger data if requested the ESD.
Flanges	Thermally butt fused to end of pipe. Install with backup rings of Type 316 stainless steel.
Transition Fittings	Where transitioning between materials and connecting to valves use HDPE MJ Adapter with metal insert, Metal Gland, Gasket, and attachment Bolts and Nuts.
Mid-Span Restraint/Wall Pipe	ISCO IPS Wall Anchor or approved equal
Gaskets	Material, size and thickness as recommended by flange manufacturer and in accordance with PPI Technical Note 38.

END OF SECTION

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SECTION 40 27 10
PIPING SPECIALTIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Mechanical Engineers (ASME):
   a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings.
   b. B16.5, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24.
   c. American Water Works Association (AWWA):
   d. C153/A21.53, Ductile-Iron Compact Fittings for Water Service.
   e. C210, Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
   f. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
   g. C219, Bolted, Sleeve-Type Couplings for Plain-End Pipe.
   h. Manual M11, Steel Pipe—A Guide for Design and Installation.
   i. ASTM International (ASTM):
   j. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   k. A276, Standard Specification for Stainless Steel Bars and Shapes.
2. National Fire Protection Association (NFPA): 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide required piping specialty items, whether shown or not shown on Drawings, as required by applicable codes and standard industry practice.

B. Rubber ring joints, mechanical joints, flexible couplings, and proprietary restrained ductile iron pipe joints are considered flexible joints; welded, screwed, and flanged pipe joints are not considered flexible.

1. Flange Adaptors.
   a. Ebaa, Series 2100 Megaflange.

2.02 CONNECTORS

A. Flexible Expansion:

1. Type: One Convolutions.
2. Materials of Construction.

a. Bellows: EPDM.
b. Flanges: Ductile Iron.
c. Reinforcing Rings: Stainless Steel.
d. Limiting Bolts: Type 304 stainless steel.
e. Pressure Rating: As Detailed.

3. Manufacturer: Proco Products, Inc., or approved equal.

B. Dismantling Fitting:

1. Material of Construction:
   a. Spool: AWWA Class D Steel Ring Flange, compatible with ANSI Class 125 and 150 bolt circles.
   b. Coating: Fusion bonded epoxy, NSF 61 certified.
   c. Tie Rods: High tensile steel per ASTM A193 grade B7.
   d. Pressure Rating: 350 psi working pressure.
2. Manufacturer: Romak, DJ400 or approved equal.

PART 3 EXECUTION

3.01 GENERAL

A. Provide accessibility to piping specialties for control and maintenance.

B. Provide dismantling fittings at all valves and pumps to facilitate removal.

3.02 FLEXIBLE PIPE CONNECTIONS TO PUMPS

A. As detailed on Drawings.

B. Limit Bolts and Control Rods: Tighten snug prior to applying pressure to system.

END OF SECTION

SECTION 40 27 20
VALVES AND OPERATORS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Mechanical Engineers (ASME):

a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

2. American Water Works Association (AWWA):

a. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

b. C508, Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.

c. C509, Resilient-Seated Gate Valves for Water Supply Service.

d. C510, Double Check Valve Backflow Prevention Assembly.

e. C512, Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.

f. C542, Electric Motor Actuators for Valves and Slide Gates.

g. C550, Protective Interior Coatings for Valves and Hydrants.

3. ASTM International (ASTM):

a. A276, Standard Specification for Stainless Steel Bars and Shapes.

b. A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.

c. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.

d. A564/A564M, Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.

PART 2 PRODUCTS

2.01 GENERAL

A. Valves to include operator, handwheel, extension stem, floor stand, operating nut, wrench, and accessories to allow a complete operation from the intended operating level.

B. Valve to be suitable for intended service. Renewable parts not to be of a lower quality than specified.

C. Valve same size as adjoining pipe, unless otherwise called out on Drawings or in Supplements.

D. Valve ends to suit adjacent piping.

E. Resilient seated valves shall have no leakage (drip-tight) in either direction at valve rated design pressure. All other valves shall have no leakage (drip-tight) in either direction at valve rated design pressure.

F. Size operators and actuators to operate valve for full range of pressures and velocities.

G. Valve to open by turning counterclockwise, unless otherwise specified.

H. Factory mount operator, actuator, and accessories.

2.02 FACTORY FINISHING

A. General:

1. Interior coatings for valves and hydrants shall be in accordance with AWWA C550, unless otherwise specified.

2. Exterior coating for valves and hydrants shall be manufacturer recommended for corrosive environments and/or direct burial.

2.03 VALVES

A. Type V100 Gate Valve 3 Inches and Smaller:

1. All-bronze, screwed bonnet, packed gland, single solid wedge gate, nonrising stem, Class 125 rated 200 psi CWP, complies with MSS SP-80 Type 1.

2. Manufacturers and Products:

a. Crane; Figure 438, NPT threaded ends.

b. Stockham; Figure B103, NPT threaded ends.

c. Crane; Figure 1324, soldered ends.

B. Type V134 Resilient Seated Ductile Iron Gate Valve 3 Inches to 12 Inches:

1. Ductile iron body, resilient seat, bronze stem and stem nut, ASME B16.1 Class 125 flanged ends, nonrising stem, in accordance with AWWA C515, minimum design working water pressure 200 psig, full port, fusion epoxy coated inside and outside per AWWA C550. NSF/ANSI 61 certified where required for the installation location.

2. Manufacturers and Products:

a. American Flow Control; Series 2500.

b. M&H; Style 7000 and C515 Large RW Valves.

C. Type V135 Resilient Seated Ductile Iron Gate Valve 3 Inches to 36 Inches:

1. Ductile iron body, resilient seat, bronze stem and stem nut, mechanical joint ends, nonrising stem, in accordance with AWWA C515, minimum design working water pressure 200 psig, full port, fusion epoxy coated inside and outside per AWWA C550. NSF/ANSI 61 certified where required for the installation location.

2. Manufacturers and Products:

a. American Flow Control; Series 2500.

b. M&H; Style 7000 and C515 Large RW Valves.

D. Type V301 Ball Valve 2 Inches and Smaller:

1. Two-piece, full port, NPT threaded ends, bronze body and end piece, stainless steel ball and stem, RTFE seats and packing, blowout-proof stem, adjustable packing gland, zinc-coated steel hand lever operator with vinyl grip, rated 600-pound WOG, 150-pound SWP, complies with MSS SP-110.

2. Manufacturers and Products:

a. Threaded:

1) Conbraco Apollo; 77-100.

2) Nibco; T-585-70.

E. Plug Valves:

1. Type V405 Eccentric Plug Valve 3 Inches to 12 Inches:

a. Nonlubricated type rated 175 psig CWP, drip-tight shutoff with pressure from either direction, cast-iron body, exposed service flanged ends per ASME B16.1 or grooved ends in accordance with AWWA C606 for rigid joints.

b. Buried service mechanical joint ends, exposed service flanged, unless otherwise shown.

c. Plug cast iron with round or rectangular port of no less than 100 percent (full port) of connecting pipe area and coated with Buna-N, seats welded nickel, stem bearings lubricated stainless steel or bronze, stem seal multiple V-rings, or U-cups with O-rings of nitrile rubber, grit seals on both upper and lower bearings.

d. For buried service, provide external epoxy coating.

e. For exposed service provided primed for coating.

f. Operators:

1) 3-Inch to 4-Inch Valves: Wrench lever manual.

2) 6-Inch to 12-Inch Valves: Totally enclosed, geared, manual operator with handwheel, 2-inch nut. Size operator for 1.5 times maximum operating shutoff pressure differential for direct and reverse pressure, whichever is higher. For buried service, provide completely sealed operator filled with heavy lubricant and 2-inch nut.

g. Manufacturers and Products:

1) DeZurik; Style PEF.

2) Milliken; Millcentric.

F. Check and Flap Valves:

1. Type V632 Ball Check Valve 3 Inches and Larger:

a. Cast iron body with epoxy coating or bronze body.

b. Suitable for wastewater service.

c. Threaded female x female connection.

d. Rated 150-pound working pressure.

e. Suitable for vertical up or horizontal flow.

f. Bolted or threaded access cover.

2. Manufacturers and Products:

a. Flowmatic Corp, 508.

b. Golden Anderson, 240-T.

3. Type V705 Swing Check Valve 2 Inches to 12 Inches:

a. AWWA C508, 125-pound flanged ends, cast-iron body, bronze body seat, bronze mounted cast-iron clapper with rubber facing, stainless steel hinge shaft.

b. Valves, 2 inches through 12 inches rated 175-pound WWP and 14 inches through 24 inches rated 150-pound WWP. Valves to be fitted with adjustable outside lever and weight. Increasing-pattern body valve may be used where increased outlet piping size is shown.

c. Manufacturers and Products:

1) M&H Valve; Style 59, 159, or 259.

2) Mueller Co.; No. A-2600 Series.

3) CCNE.

G. Self-Regulated Automatic Valves:

1. Type V750, Sewage Air and Vacuum Valve 2 Inches to 8 Inches (Combination Valve):

a. Suitable for sewage service; automatically exhausts air during system filling and allows air to re-enter during draining or when vacuum occurs.

b. Rated working pressure of 150 psi with operating pressure and orifice size as indicated on Drawings.

c. Materials: Cast or Ductile iron with fusion bonded epoxy coating or stainless steel.

d. Sewage air and vacuum valve fitted with:

1) Blowoff valve.

2) Isolation valve, V134 or V301.

3) Flushing valve with quick disconnect couplings, and a minimum 5 feet of hose with quick disconnect couplings to permit backflushing after installation without dismantling valve.

e. Manufacturers and Products:

1) ARI, D-026.

2) H-Tec; 986.

2. Type V752 Sewage Air Release Valve 2 Inches to 4 Inches:

a. Suitable for sewage service; automatically exhausts entrained air that accumulates in a system.

b. Rated working pressure of 150 psi, operating pressure and orifice size as indicted on Drawings.

c. Materials: Cast or Ductile iron with fusion bonded epoxy coating or stainless steel.

d. Sewage air release valve fitted wit:

1) Blowoff valve.

2) Isolation valve, V134 or V301.

3) Flushing valve with quick disconnect couplings, and a minimum 5 feet of hose with quick disconnect couplings to permit backflushing after installation without dismantling valve.

e. Manufacturers and Products:

1) ARI, D-020 or S-020.

2) Val-Matic Valve; Series 48 or 49.

2.04 ACCESSORIES

A. Cast-Iron Valve Box: Designed for traffic loads, sliding type, with minimum of 5-1/4-inch ID shaft.

1. Box: Cast iron with minimum depth of 9 inches.

2. Lid: Cast iron, minimum depth 3 inches, nonlocking type, marked SEWER.

3. Extensions cast iron.

4. Two-piece box and lid for valves 4 inches through 12 inches, three-piece box and lid for valves larger than 12 inches with base sized for valve.

5. Valve extension stem for valves with operating nuts 3 feet or greater below finish grade.

6. Manufacturers and Products:

   a. East Jordan Iron Works; Cast-Iron Valve Boxes.

   b. Bingham & Taylor; Cast-Iron Valve Boxes.

PART 3 EXECUTION

3.01 INSTALLATION

A. Flange Ends:

1. Flanged valve bolt holes shall straddle vertical centerline of pipe.

2. Clean flanged faces, insert gasket and bolts, and tighten nuts progressively and uniformly.

B. Screwed Ends:

1. Clean threads by wire brushing or swabbing.

2. Apply joint compound.

C. Valve Installation and Orientation:

1. General:

   a. Install valves so handles operate from fully open to fully closed without encountering obstructions.

   b. Install valves in location for easy access for routine operation and maintenance.

   c. Install valves per manufacturer’s recommendations.

2. Eccentric Plug Valves:

   a. Unless otherwise restricted or shown on Drawings, install valve as follows: Install valve in horizontal position with seat in highest portion of valve (seat up).

3. Check Valves: Install swing check valve with shaft in horizontal position.

4. Self-Regulated Automatic Valves:

a. Install on a tee. Installation on tap is not allowed.

b. Install with isolation valve in accordance with detail.

D. Locate valve to provide accessibility for control and maintenance. Install access doors in finished walls and plaster ceilings for valve access.

E. Extension Stem for Operator: Where depth of valve operating nut is 3 feet or greater below finish grade, furnish operating extension stem with 2-inch operating nut to bring operating nut to a point within 6 inches of finish grade.

3.02 TESTS AND INSPECTION

A. Valve may be either tested while testing pipelines, or as a separate step.

B. Test that valves open and close smoothly under operating pressure conditions. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.

C. Inspect air and vacuum valves as pipe is being filled to verify venting and seating is fully functional.

D. Count and record number of turns to open and close valve; account for discrepancies with manufacturer's data.

END OF SECTION

SECTION 40 42 13
PROCESS PIPING INSULATION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Heating, Refrigerating and Air Conditioning Engineers Inc. (ASHRAE): 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.

2. ASTM International (ASTM):

a. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

b. C165, Standard Test Method for Measuring Compressive Properties of Thermal Insulations.

c. C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

d. C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

e. C534/C534M, Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

f. C547, Standard Specification for Mineral Fiber Pipe Insulation.

g. C552, Standard Specification for Cellular Glass Thermal Insulation.

h. C585, Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.

i. C1136, Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

j. C1729, Standard Specification for Aluminum Jacketing for Insulation.

k. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

l. E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.

3. International Code Council (ICC): International Energy Conservation Code (IECC).

4. Underwriters Laboratories Inc. (UL).

PART 2 PRODUCTS

2.01 PIPE AND FITTING INSULATION

A. Type 2—Fiberglass:

1. Material: UL rated, preformed, sectional bonded fiberglass per ASTM C585 with factory applied, Kraft paper with aluminum foil vapor barrier jacket with pressure-sensitive, self-sealing lap.

2. Insulation Temperature Rating: Zero to 850 degrees F.

3. Conductivity in accordance with ASHRAE 90.1 and maximum numerical value of 0.23 Btu-in./hr-square foot degrees F at 75 degrees F.

4. Jacketing per ASTM C1136 with minimum water vapor transmission for jacket of 0.02 perm-inch per ASTM E96/E96M. Furnish with no jacket if field finish system specified.

5. Joints: Matching pressure-sensitive butt strips for sealing circumferential joints.

6. Flame Spread Rating: Less than 25 per ASTM E84.

7. Smoke Developed Index: Less than 50 per ASTM E84.

8. Manufacturers and Products:

a. Owens Corning Fiberglass; ASJ/SSL-11.

b. John Manville; Micro-Lok with Jacket.

2.02 INSULATION AT PIPE HANGERS AND SUPPORTS

A. Refer to Section 40 05 15, Piping Support Systems.

B. Copper, Ductile Iron, and Nonmetallic Pipe: High-density insert, thickness equal to adjoining insulation of Type 3 or other rigid insulation or manufactured pre-insulated pipe hanger and insulation shield. Extend insert beyond shield.

2.03 INSULATION FINISH SYSTEMS

A. Type F1—PVC.

B. Type F3—Aluminum:

1. Aluminum Roll Jacketing: For straight run piping, wrought aluminum Alloy 3003, 5005, 1100, or 3105 to ASTM B209 with H-14 temper, in accordance with ASTM C1729, minimum 0.016-inch thickness, with smooth mill finish.

2. Vapor Barrier: Provide factory applied vapor barrier, heat and pressure bonded to inner surface of aluminum jacketing.

3. Fitting Covers: Material as for aluminum roll jacketing, premolded, one or two piece covers, which includes elbows, tee/valves, end caps, mechanical line couplings, and specialty fittings.

4. Manufacturers:

a. RPR Products; Insul-Mate.

b. ITW, Pabco-Childers.

PART 3 EXECUTION

3.01 APPLICATION

A. General:

1. Insulate valve bodies, flanges, and pipe couplings.

2. Insulate and vapor seal hangers, supports, anchors, and other piping appurtenances that are secured directly to cold surfaces.

3. Do not insulate flexible pipe couplings and expansion joints.

4. Service and Insulation Thickness: Refer to Supplement Service and Insulation Thickness table following “End of Section” and to Piping Schedule in Section 40 27 00, Force Main Piping—General.

3.02 INSTALLATION

A. General:

1. Install in accordance with manufacturer’s instructions and as specified herein.

2. Install after piping system has been pressure tested and leaks corrected.

3. Install over clean dry surfaces.

4. Use insulating cements, lagging adhesives, and weatherproof mastics recommended by insulation manufacturer.

5. Do not allow insulation to cover nameplates or code inspection stamps.

6. Run insulation or insulation inserts continuously through pipe hangers and supports, wall openings, ceiling openings, and pipe sleeves, unless otherwise shown.

7. Install removable insulation sections on devices that require access for maintenance of equipment or removal, such as unions and strainer end plates.

8. Personnel Protection: Install on pipes from floor to 8 feet high. Install on pipes within 4 feet of platforms and to 8 feet high above platforms.

B. Connection to Existing Piping: Cut back existing insulation to remove portion damaged by piping revisions. Install new insulation.

C. Cold Surfaces: Provide continuous vapor seal on insulation on cold surfaces where vapor barrier jackets are used.

D. Placement.

E. Insulate valves and fittings with sleeved or cut pieces of same material.

F. Seal and tape joints.

G. Heat Traced Piping: Apply insulation after heat-tracing work is completed and inspected.

H. Vapor Barrier:

1. Provide continuous vapor barrier at joints between rigid insulation and pipe insulation.

2. Install vapor barrier jackets with pipe hangers and supports outside jacket.

3. Do not use staples and screws to secure vapor sealed system components.

I. Aluminum Jacket:

1. Use continuous friction type joint to hold jacket in place, providing positive weatherproof seal over entire length of jacket.

2. Secure circumferential joints with preformed snap straps containing weatherproof sealant.

3. On exterior piping, apply coating over insulation and vapor barrier to prevent damage when aluminum fitting covers are installed.

4. Do not use screws or rivets to fasten fitting covers.

5. Install removable prefabricated aluminum covers on exterior flanges and unions.

6. Caulk and seal exterior joints to make watertight.

3.03 FIELD FINISHING

A. Apply coating of insulating cement where needed to obtain smooth and continuous appearance.

B. Where pipe labels or banding are specified, apply to finished insulation, not to pipe.

C. Painting Piping Insulation (Exposed to View): Aluminum or color coded PVC jacketing does not require painting.

3.04 SUPPLEMENTS

A. The supplement listed below, following “End of Section,” is a part of this Specification:

1. Service and Insulation Thickness Table.

END OF SECTION

Service and Insulation Thickness								
Service Type	**Pipe Legend**	**Thickness**	**Fluid Temperature (degrees F)***	**Insulation**	**Finish Systems**			
					Concealed from View	**Indoors Exposed**	**Outdoors**	**Buried**
HT–Piping requiring heat tracing.	FC	Pipe Size: Insulation Thickness Inches:* 1/4-3: 1 3.5-10: 1.5	50 to 90	Type 2 Insulate and heat trace outside lines above grade.	None	F3	F3	N/A
Use these fluid temperatures unless otherwise noted in the Piping Schedule. Inches: Based upon insulation with glass fiber per ASTM C547, outdoors with 20 mph wind with 10 percent safety and no value assigned to cladding or air space at cladding. Matches the watts per foot in Section 40 05 33, Pipe Heat Tracing. 2012 IECC requires 1-inch minimum thickness.								

SECTION 40 80 01
PIPING LEAKAGE TESTING

PART 1 GENERAL (NOT USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PREPARATION

A. Develop and review testing procedure with piping system manufacturer.

B. Notify the ESD in writing 5 days in advance of testing. Perform testing in presence of the ESD.

C. Pressure Piping:

1. Install temporary thrust blocking or other restraint as necessary to protect adjacent piping or equipment and make taps in piping prior to testing.

2. Wait 10 days minimum after concrete thrust blocking is installed to perform pressure tests. If high-early strength cement is used for thrust blocking, wait may be reduced to 2 days.

3. Prior to test, remove or suitably isolate appurtenant instruments or devices that could be damaged by pressure testing.

4. Test Pressure: As Detailed on the Drawings.

D. Test section may be filled with water and allowed to stand under low pressure prior to testing.

3.02 HYDROSTATIC TEST

A. General:

1. Testing of pipe shall be accomplished before grouting pipe in any casings.

2. Test newly installed pipelines. Using water as test medium, pipes shall successfully pass a leakage test prior to acceptance.

3. Furnish testing equipment and perform tests in manner satisfactory to Engineer. Testing equipment shall provide observable and accurate measurements of leakage under specified conditions.

4. Supply temporary water for completion of test.

5. Dispose of water used in testing in accordance with applicable regulations.

6. Procedure:

    a. Maximum filling velocity shall not exceed 0.25 foot per second, calculated based on the full area of pipe.

    b. Expel air from pipe system during filling. Expel air through air release valve or through corporation stop installed at high points and other strategic points.

    c. Test pressure shall be 150 percent of the operating pressure as measured at the low point.

    d. Test as pressure shall be for a minimum of 1 hour.

    e. Apply and maintain specified test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.

    f. If measured leakage exceeds allowable leakage or if leaks are visible, repair defective pipe section and repeat hydrostatic test.

    g. For high density polyethylene pipe, test procedure shall be in accordance with ASTM F2164.

        1) Initial Expansion Phase: Add water as required to maintain test pressure for 4 hours.

        2) Test Phase: Reduce pressure by 10 psi and start pressure test.

        3) Test is successful if pressure says within 5 percent of initial value for 1 hour.

7. Allowable Leakage: Allowable leakage is zero.

3.03 FIELD QUALITY CONTROL

A. Test Report Documentation:

1. Test date.
2. Description and identification of piping tested.
3. Test fluid.
4. Test pressure.
5. Remarks, including:

    a. Leaks (type, location).

    b. Repair/replacement performed to remedy excessive leakage.

END OF SECTION

SECTION 40 90 01
INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):

a. A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

b. A276, Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.

c. A312, Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.

d. B32, Standard Specification for Solder Metal.

e. B88, Standard Specification for Seamless Copper Water Tube.

2. International Society of Automation (ISA):

a. S5.1, Instrumentation Symbols and Identification (NRC ADOPTED).

b. PR12.6, Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations.

c. S5.4, Standard Instrument Loop Diagrams.

d. S20, Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.

e. S50.1, Compatibility of Analog Signals for Electronic Industrial Process Instruments.

3. National Electrical Manufacturers Association (NEMA):

a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).

b. ICS 1, General Standards for Industrial Control and Systems.

4. National Institute of Standards and Technology (NIST).

5. Underwriters Laboratory, Inc. (UL): 508A, Standard for Safety, Industrial Control Panels.

1.02 SUMMARY

A. Work Includes:

1. Engineering, furnishing, installing, calibrating, adjusting, testing, documenting, starting up, and Owner training for complete Process Instrumentation and Control (PIC).

2. All pump station shall include a Mission RTU-150 for remote monitoring.

1.03 DEFINITIONS

A. Abbreviations:

1. LCP: Local Control Panel.

2. PAT: Performance Acceptance Test.

3. PIC: Process Instrumentation and Control.

4. PLC: Programmable Logic Controller.

B. Rising/Falling: Terms used to define actions of discrete devices about their setpoints.

1. Rising: Contacts close when an increasing process variable rises through setpoint.

2. Falling: Contacts close when a decreasing process variable falls through setpoint.

C. Signal Types:

1. Analog Signals, Current Type:

a. 4 mA to 20 mA dc signals conforming to ISA S50.1.

b. Unless otherwise indicated for specific PIC Subsystem components, use the following ISA 50.1 options:

1) Transmitter Type: Number 2, two-wire.

2) Transmitter Load Resistance Capacity: Class L.

3) Fully isolated transmitters and receivers.

2. Analog Signals, Voltage Type: 1 to 5 volts dc within panels where a common high precision dropping resistor is used.

3. Discrete signals, two-state logic signals using dc or 120V ac sources as indicated.

D. Instrument Tag Numbers:

1. A shorthand tag number notation is used in the Loop Specifications. For example: AI-1-2(2)(3)[pH].

Notation	Explanation
AI	ISA designator for Analysis Indicator.
1	Unit process number.
2	Loop number.
(2)	First unit number; number of same component types in a given loop; -1 and -2 in this example.
(3)	Second unit number; number of same component types with same first unit number in a given loop; -1, -2, and –3 in this example.
[pH]	Same notation shown at 2 o'clock position on ISA circle symbol on P&ID.

2. In this example, AI-1-12(2)(3)[pH] is shorthand for:

AI-1-12-1-1[pH], AI-1-12-1-2[pH], AI-1-12-1-3[pH]
AI-1-12-2-1[pH], AI-1-12-2-2[pH], AI-1-12-2-3[pH]

1.04 QUALITY ASSURANCE

A. Calibration Instruments: Each instrument used for calibrating PIC equipment shall bear the seal of a reputable laboratory certifying that instrument has been calibrated within the previous 12 months to a standard endorsed by the NIST.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide Site and warehouse storage facilities for PIC equipment.

B. Prior to shipment, include corrosive-inhibitive vapor capsules in shipping containers, and related equipment as recommended by the capsule manufacturer.

C. Prior to installation, store items in dry indoor locations. Provide heating in storage areas for items subject to corrosion under damp conditions.

D. Cover panels and other elements that are exposed to dusty construction environments.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Standard Environmental Requirements: Unless otherwise noted, design equipment for continuous operation in these environments:

1. Freestanding Panel and Consoles:

a. Inside, Air Conditioned: NEMA 1.

b. Inside: NEMA 12.

2. Smaller Panels and Assemblies (that are not Freestanding):

a. All Other Locations: NEMA 4X.

3. Field Elements: Outside.

B. Environmental Design Requirements: Following defines the types of environments referred to in the above.

1. Outside:

a. Temperature: Minus 20 to 104 degrees F.

b. Relative Humidity: 10 to 100 percent.

c. NEC Classification: Nonhazardous.

2. Outside, Corrosive:

a. Temperature: Minus 20 to 104 degrees F.

b. Relative Humidity: 0 to 100 percent.

c. Corrosive Environment: Hydrogen sulfide gas.

d. NEC Classification: Nonhazardous.

PART 2 PRODUCTS

2.01 GENERAL

A. Furnish equipment items as required. Furnish all materials, equipment, and software, necessary to effect required system and loop performance.

B. First Named Manufacturer: PIC design is based on first named manufacturers of equipment and materials.

1. If an item is proposed from other than first named manufacturer, obtain approval from Engineer for such changes in accordance with Article Submittals.

2. If using proposed item requires other changes, provide work and equipment to implement these changes. Changes that may be required include, but are not limited to: different installation, wiring, raceway, enclosures, connections, isolators, intrinsically safe barriers, software, and accessories.

C. Like Equipment Items:

1. Use products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's services.

2. Implement all same or similar functions in same or similar manner. For example, control logic, sequence controls, and display layouts.

2.02 I&C COMPONENTS

A. Components for Each Loop: Furnish all equipment that is necessary to achieve required loop performance.

B. Component Specifications: Generalized specifications for each type of component are located in paragraph Supplements.

2.03 NAMEPLATES AND TAGS

A. Panel Nameplates: Enclosure identification located on the enclosure face.

1. Location and Inscription: As shown.

2. Materials: Laminated plastic attached to panel with stainless steel screws.

3. Letters: 1/2-inch white on black background, unless otherwise noted.

B. Component Nameplates—Panel Face: Component identification located on panel face under or near component.

1. Location and Inscription: As shown.

2. Materials: Laminated plastic attached to panel with stainless steel screws.

3. Letters: 3/16-inch white on black background, unless otherwise noted.

C. Component Nameplates—Back of Panel: Component identification located on or near component inside of enclosure.

1. Inscription: Component tag number.

2. Materials: Adhesive backed, laminated plastic.

3. Letters: 3/16-inch white on black background, unless otherwise noted.

D. Legend Plates for Panel Mounted Pushbuttons, Lights, and Switches.

1. Inscription: Refer to:

a. Table under paragraph Standard Pushbutton Colors and Inscriptions.

b. Table under paragraph Standard Light Colors and Inscriptions.

c. P&IDs in Drawings.

2. Materials: Stainless steel, keyed legend plates. Secured to panel by mounting nut for pushbutton, light, or switch.

3. Letters: Black on gray or white background.

E. Service Legends: Component identification nameplate located on face of component.

1. Inscription: As shown.

2. Materials: Adhesive backed, laminated plastic.

3. Letters: 3/16-inch white on black background, unless otherwise noted.

F. Nametags: Component identification for field devices.

1. Inscription: Component tag number.

2. Materials: 16-gauge, Type 304 stainless steel.

3. Letters: 3/16-inch imposed.

4. Mounting: Affix to component with 16- or 18-gauge stainless steel wire or stainless steel screws.

2.04 ELECTRICAL REQUIREMENTS

A. In accordance with Division 26, Electrical.

B. I&C and electrical components, terminals, wires, and enclosures: UL listed.

C. Wires within Enclosures:

1. ac Circuits:

a. Type: 600-volt, Type MTW stranded copper.

b. Size: For current to be carried, but not less than 18 AWG.

2. Analog Signal Circuits:

a. Type: 600-volt stranded copper, twisted shielded pairs.

b. Size: 18 AWG, minimum.

3. Other dc Circuits.

a. Type: 600-volt, Type MTW stranded copper.

b. Size: For current carried, but not less than 18 AWG.

4. Special Signal Circuits: Use manufacturer’s standard cables.

5. Wire Identification: Numbered and tagged at each termination.

a. Wire Tags: Machine printed, heat shrink.

b. Manufacturers:

1) Brady PermaSleeve.

2) Tyco Electronics.

D. Wires entering or leaving enclosures, terminate and identify as follows:

1. Analog and discrete signal, terminate at numbered terminal blocks.

2. Special signals, terminated using manufacturer's standard connectors.

E. Terminal Blocks for Enclosures:

1. Quantity:

a. One wire per terminal for field wires entering enclosures.

b. Maximum of two wires per terminal for 18-WG wire for internal enclosure wiring.

c. Spare Terminals: 20 percent of all connected terminals, but not less than 10 per terminal block.

2. General:

a. Connection Type: Screw compression clamp.

b. Compression Clamp:

1) Complies with DIN-VDE 0611.

2) Hardened steel clamp with transversal groves that penetrate wire strands providing a vibration-proof connection.

3) Guides strands of wire into terminal.

c. Screws: Hardened steel, captive and self-locking.

d. Current Bar: Copper or treated brass.

e. Insulation:

1) Thermoplastic rated for minus 55 to plus 110 degree C.

2) Two funneled shaped inputs to facilitate wire entry.

f.Mounting:

1) Standard DIN rail.

2) Terminal block can be extracted from an assembly without displacing adjacent blocks.

3) End Stops: Minimum of one at each end of rail.

g. Wire preparation: Stripping only permitted.

h. Jumpers: Allow jumper installation without loss of space on terminal or rail.

i. Marking System:

1) Terminal number shown on both sides of terminal block.

2) Allow use of preprinted and field marked tags.

3) Terminal strip numbers shown on end stops.

4) Mark terminal block and terminal strip numbers as shown on Panel Control Diagrams and Loop Diagrams.

5) Fuse Marking for Fused Terminal Blocks: Fuse voltage and amperage rating shown on top of terminal block.

j. Test Plugs: Soldered connections for 18 AWG wire.

1) Pin Diameter: 0.079 inch.

2) Manufacturer and Product: Entrelec; Type FC2.

3. Terminal Block, General-Purpose:

a. Rated Voltage: 600V ac.

b. Rated Current: 30 amp.

c. Wire Size: 22 AWG to 10 AWG.

d. Rated Wire Size: 10 AWG.

e. Color: Grey body.

f. Spacing: 0.25 inch, maximum.

g. Test Sockets: One screw test socket 0.079-inch diameter.

h. Manufacturer and Product: Entrelec; Type M4/6.T.

4. Terminal Block, Ground:

a. Wire Size: 22 AWG to 12 AWG.

b. Rated Wire Size: 12 AWG.

c. Color: Green and yellow body.

d. Spacing: 0.25 inch, maximum.

e. Grounding: Ground terminal blocks electrically grounded to the mounting rail.

f. Manufacturer and Product: Entrelec; Type M4/6.P.

5. Terminal Block, Blade Disconnect Switch:

a. Rated Voltage: 600V ac.

b. Rated Current: 10-amp.

c. Wire Size: 22 AWG to 12 AWG.

d. Rated Wire Size: 12 AWG.

e. Color: Grey body, orange switch.

f. Spacing: 0.25 inch, maximum.

g. Manufacturer and Product: Entrelec; Type M4/6.SN.T.

6. Terminal Block, Fused, 24V dc:

a. Rated Voltage: 600V dc.

b. Rated Current: 16-amp.

c. Wire Size: 22 AWG to 10 AWG.

d. Rated Wire Size: 10 AWG.

e. Color: Grey body.

f. Fuse: 0.25 inch by 1.25 inches.

g. Indication: LED diode 24V dc.

h. Spacing: 0.512 inch, maximum.

i. Manufacturer and Product: Entrelec; Type M10/13T.SFL.

7. Terminal Block, Fused, 120V ac:

a. Rated Voltage: 600V ac.

b. Rated Current: 16-amp.

c. Wire Size: 22 AWG to 10 AWG.

d. Rated Wire Size: 10 AWG.

e. Color: Grey body.

f. Fuse: 0.25 inch by 1.25 inches.

g. Indication: Neon Lamp 110V ac.

h. Leakage Current: 1.8 mA, maximum.

i. Spacing: 0.512 inch, maximum

j. Manufacturer and Product: Entrelec; Type M10/13T.SFL.

8. Terminal Block, Fused, 120V ac, High Current:

a. Rated Voltage: 600V ac.

b. Rated Current: 35 amps.

c. Wire Size: 18 AWG to 8 AWG.

d. Rated Wire Size: 8 AWG.

e. Color: Grey.

f. Fuse: 13/32 inch by 1.5 inches.

g. Spacing: 0.95 inch, maximum.

h. Manufacturer and Product: Entrelec; Type MB10/24.SF.

F. Grounding of Enclosures:

1. Furnish isolated copper grounding bus for signal and shield ground connections.

2. Ground bus grounded at a common signal ground point in accordance with National Electrical Code requirements.

3. Single Point Ground for Each Analog Loop:

a. Locate at dc power supply for loop.

b. Use to ground wire shields for loop.

4. Ground terminal block rails to ground bus.

G. Analog Signal Isolators: Furnish signal isolation for analog signals that are sent from one enclosure to another. Do not wire in series instruments on different panels, cabinets, or enclosures.

H. Power Distribution within Panels:

1. Feeder Circuits:

a. Make provisions for feeder circuit conduit entry.

b. Furnish terminal board for termination of wires.

2. Power Panel: Furnish main circuit breaker and a circuit breaker on each individual branch circuit distributed from power panel.

a. Locate to provide clear view of and access to breakers when door is open.

b. Breaker sizes: Coordinate such that fault in branch circuit will blow only branch breaker but not trip the main breaker.

c. Breaker Manufacturers and Products: Refer to Division 26, Electrical.

3. Circuit Wiring: Use following rules for actual circuit wiring:

a. Devices on Single Circuit: 20, maximum.

b. Multiple Units Performing Parallel Operations: To prevent failure of any single branch circuit from shutting down entire operation, do not group all units on same branch circuit.

c. Branch Circuit Loading: 12 amperes continuous, maximum.

d. Panel Lighting and Service Outlets: Put on separate 15-amp, 120V ac branch circuit.

e. Provide 120V ac plugmold for panel components with line cords.

I. Electrical Transient Protection:

1. Provide on incoming power to panel and all analog signals.

2. Function: Protect elements of PIC against damage due to electrical transients induced in interconnecting lines by lightning and nearby electrical systems.

3. Implementation: Provide, install, coordinate, and inspect grounding of surge suppressors at:

a. Connection of ac power to PIC equipment including panels, consoles assembles, and field mounted analog transmitters and receivers.

b. At the field and panel, console, or assembly connection of signal circuits that have portions of the circuit extending outside of a protective building.

4. Construction: First-stage high energy metal oxide varistor and second-stage bipolar silicon avalanche device separated by series impedance. Includes grounding wire, stud, or terminal.

5. Response: 5 nanoseconds maximum.

6. Recovery: Automatic.

7. Temperature Range: Minus 20 degrees C to plus 85 degrees C.

J. Signal Distribution:

1. Within Panels: 4 mA to 20 mA dc signals may be distributed as 1 to 5V dc.

2. Outside Panels: Isolated 4 mA to 20 mA dc only.

3. All signal wiring twisted in shielded pairs.

K. Relays:

1. General:

a. Relay Mounting: Plug-in type socket.

b. Relay Enclosure: Furnish dust cover.

c. Socket Type: Screw terminal interface with wiring.

d. Socket Mounting: Rail.

e. Provide holddown clips.

2. Control Circuit Switching Relay, Nonlatching:

a. Type: Compact general-purpose plug-in.

b. Contact Arrangement: 3 Form C contacts.

c. Contact Rating: 10A at 28V dc or 240V ac.

d. Contact Material: Silver cadmium oxide alloy.

e. Coil Voltage: As noted or shown.

f.Coil Power: 1.8 watts (dc), 2.7VA (ac).

g. Expected Mechanical Life: 10,000,000 operations.

h. Expected Electrical Life at Rated Load: 100,000 operations.

i. Indication Type: Neon or LED indicator lamp.

j. Push to test button.

k. Manufacturer and Product: Potter and Brumfield; Series KUP.

3. Control Circuit Switching Relay, Latching:

a. Type: Dual coil mechanical latching relay.

b. Contact Arrangement: 2 Form C contacts.

c. Contact Rating: 10A at 28V dc or 120V ac.

d. Contact Material: Silver cadmium oxide alloy.

e. Coil Voltage: As noted or shown.

f. Coil Power: 2.7 watts (dc), 5.3VA (ac).

g. Expected Mechanical Life: 500,000 operations.

h. Expected Electrical Life at Rated Load: 50,000 operations.

i. Manufacturer and Product: Potter and Brumfield; Series KB/KBP.

4. Control Circuit Switching Relay, Time Delay:

a. Type: Adjustable time delay relay.

b. Contact Arrangement: 2 Form C contacts.

c. Contact Rating: 10A at 240V ac.

1) Contact Material: Silver cadmium oxide alloy.

d. Coil Voltage: As noted or shown.

e. Operating Temperature: Minus 10 to 55 degrees C.

f. Repeatability: Plus or minus 2 percent.

g. Delay Time Range: Select range such that time delay setpoint fall between 20 to 80 percent of range.

h. Time Delay Setpoint: As noted or shown.

i. Mode of Operation: As noted or shown.

j. Adjustment Type: Integral potentiometer with knob external to dust cover.

k. Manufacturer and Products: Potter and Brumfield:

1) Series CB for 0.1 second to 100 minute delay time ranges.

2) Series CK for 0.1 to 120 second delay time ranges.

L. Power Supplies:

1. Furnish to power instruments requiring external dc power, including two-wire transmitters and dc relays.

2. Convert 120V ac, 60-Hz power to dc power of appropriate voltage(s) with sufficient voltage regulation and ripple control to assure that instruments being supplied can operate within their required tolerances.

3. Provide output over voltage and over current protective devices to:

a. Protect instruments from damage due to power supply failure.

b. Protect power supply from damage due to external failure.

4. Enclosures: NEMA 1 in accordance with NEMA 250.

5. Mount such that dissipated heat does not adversely affect other components.

6. Fuses: For each dc supply line to each individual two-wire transmitter.

a. Type: Indicating.

b. Mount so fuses can be easily seen and replaced.

M. Internal Panel Lights for Freestanding Panels:

1. Type: Switched 100-watt incandescent back-of-panel lights.

2. Quantity: One light for every 4 feet of panel width.

3. Mounting: Inside and in the top of back-of-panel area.

4. Protective metal shield for lights.

N. Service Outlets for Freestanding Panels:

1. Type: Three-wire, 120-volt, 15-ampere, GFCI duplex receptacles.

2. Quantity:

a. For panels 4 feet wide and smaller: One.

b. For panels wider than 4 feet: One for every 4 feet of panel width, two minimum per panel.

3. Mounting: Evenly spaced along back-of-panel area.

O. Internal Panel Lights and Service Outlets for Smaller Panels:

1. Internal Panel Light: Switched 100-watt incandescent light.

2. Service Outlet: Breaker protected 120-volt, 15-amp, GFCI duplex receptacle:

P. Standard Pushbutton Colors and Inscriptions: Use following color code and inscriptions for pushbuttons, unless otherwise noted.

Tag Function	**Inscription(s)**	**Color**
OO	ON OFF	Black Black
OC	OPEN CLOSE	Black Black
OCA	OPEN CLOSE AUTO	Black Black Black
OOA	ON OFF AUTO	Black Black Black
MA	MANUAL AUTO	Black Black
SS	START STOP	Black Black
RESET	RESET	Black
EMERGENCY STOP	EMERGENCY STOP	Red

a. Lettering Color:

1) Black on white and yellow buttons.

2) White on black, red, and green buttons.

Q. Standard Light Colors and Inscriptions: Use following color code and inscriptions for service legends and lens colors for indicating lights, unless otherwise noted.

Tag Function	Inscription(s)	Color
ON	ON	Red
OFF	OFF	Green
OPEN	OPEN	Red
CLOSED	CLOSED	Green
LOW	LOW	Green
FAIL	FAIL	Amber
HIGH	HIGH	Red
AUTO	AUTO	White
MANUAL	MANUAL	Yellow
LOCAL	LOCAL	White
REMOTE	REMOTE	Yellow

1. Lettering Color:

a. Black on white and amber lenses.

b. White on red and green lenses.

2.05 REMOTE MONITORING

A. Mission MyDro M150. No equal or alternate.

2.06 TEST EQUIPMENT AND TOOLS

Item	Qty.	Options and Model
Digital Multimeter	2	Fluke Model 87V/E Industrial Electrician Combo Kit with test leads, removable test probes, long reach alligator clips, magnetic hanger, temperature probe, and carrying case.
Clamp-on Ammeter	1	3-1/2-digit display unit with protective case; TES Model 3040 or Fluke Model 337E.
DC Digital Process Signal Calibrator	2	Portable, two-channel, with test leads, rechargeable batteries, charger, and carrying case; Transmation Model 1045-01.
Recorder	1	Portable, two-channel, batteries, carrying case, Z-fold charts. Powered by internal rechargeable batteries and external 120V ac and 12V dc. Input ranges from 10mV to 50V dc. Chart speeds from 60 cm/min to 2cm/hr; Omega Model RD3057-22.
Pressure and Electrical Calibrator	1	Transmation Model 1091PLUS-LP with test leads, rechargeable batteries, ac charger, pressure transducer modules, and protective case. Transducer pressure ranges: Appropriate for pressure devices provided.
Pressure Pump Kit	1	Hand pump (0 to 300 psig), calibration labels, tubing, fittings, and carrying case. Transmation Pump Kit 22980P-300.
Small Tool Kit	1	Kit of instrument maintenance tools in soft, zipper case; Jensen Tools Model JTK-47CG Field Engineer's Kit.
Large Tool Kit	1	Kit of instrument maintenance tools in high-density polyethylene case; Jensen Tools Model JTK-17LST.
Screw Starters	1	Kits of slotted screw starters with magnetic retrievers; Jensen Tools Model 23B021 and 23B023.

Item	Qty.	Options and Model
Terminal Kit	1	Kit of solderless terminals and cable ties; Jensen Tools Model 23B210.

2.07 SPARE PARTS

Description	Percent of Each Type and Size Used	No Less Than
Annunciator light bulbs	20	10
Annunciator window module	10	[5
dc power supplies	20	2
Fuses	20	5
Indicating light bulb	20	10
Relays	20	3
Terminal Blocks	10	10
Hand Switches	10	5

2.08 FABRICATION

A. General:

1. Panels with external dimensions and instruments arrangement as shown on Drawings.

2. Panel Construction and Interior Wiring: In accordance with the National Electrical Code, state and local codes, NEMA, ANSI, UL, and ICECA.

3. Fabricate panels, install instruments, wire, and plumb, at the PIC factory.

4. Electrical Work: In accordance with Division 26, Electrical.

B. Factory Assembly: Assemble panels at the manufacturer's factory. No fabrication other than correction of minor defects or minor transit damage shall be done on panels at Site.

C. UL Listing Mark for Enclosures: Mark stating "Listed Enclosed Industrial Control Panel" per UL 508A.

D. Wiring Within PIC Panels:

1. Restrain by plastic ties or ducts or metal raceways.

2. Hinge Wiring: Secure at each end so that bending or twisting will be around longitudinal axis of wire. Protect bend area with sleeve.

3. Arrange wiring neatly, cut to proper length, and remove surplus wire.

4. Abrasion protection for wire bundles which pass through holes or across edges of sheet metal.

5. Connections to Screw Type Terminals:

a. Locking-fork-tongue or ring-tongue lugs.

b. Use manufacturer's recommended tool with required sized anvil to make crimp lug terminations.

c. Wires terminated in a crimp lug, maximum of one.

d. Lugs installed on a screw terminal, maximum of two.

6. Connections to Compression Clamp Type Terminals:

a. Strip, prepare, and install wires in accordance with terminal manufacturer's recommendations.

b. Wires installed in a compression screw and clamp, maximum of one for field wires entering enclosure, otherwise maximum of two.

7. Splicing and tapping of wires, allowed only at device terminals or terminal blocks.

8. Terminate 24V dc and analog signal circuits on separate terminal block from ac circuit terminal blocks.

9. Separate analog and dc circuits by at least 6 inches from ac power and control wiring, except at unavoidable crossover points and at device terminations.

10. Arrange wiring to allow access for testing, removal, and maintenance of circuits and components.

11. Plastic Wire Ducts Fill: Do not exceed manufacturer's recommendation.

E. Temperature Control:

1. Freestanding Panels:

a. Nonventilated Panels: Size to adequately dissipate heat from equipment mounted inside panel or on panel.

b. Ventilated Panels:

1) Furnish with louvers and forced ventilation as required to prevent temperature buildup from equipment mounted inside panel or on panel.

2) For panels with backs against wall, furnish louvers on top and bottom of panel sides.

3) For panels without backs against wall, furnish louvers on top and bottom of panel back.

4) Louver Construction: Stamped sheet metal.

5) Ventilation Fans:

a) Furnish where required to provide adequate cooling.

b) Create positive internal pressure within panel.

c) Fan Motor Power: 120V ac, 60-Hz, thermostatically controlled.

6) Air Filters: Washable aluminum, Hoffman Series A-FLT.

c. Air Conditioned Panels: Where required for continuous operation of equipment. Design of system is subject to the approval of the ESD.

2. Space Heaters:

a. Thermostatically controlled to maintain internal panel temperatures above dew point.

b. Required for following panels:

F. Freestanding Panel Construction:

1. Materials: Sheet steel, unless otherwise shown on Drawings with minimum thickness of 10-gauge, unless otherwise noted.

2. Panel Fronts:

a. Fabricated from a single piece of sheet steel, unless otherwise shown on Drawings.

b. No seams or bolt heads visible when viewed from front.

c. Panel Cutouts: Smoothly finished with rounded edges.

d. Stiffeners: Steel angle or plate stiffeners or both on back of panel face to prevent panel deflection under instrument loading or operation.

3. Internal Framework:

a. Structural steel for instrument support and panel bracing.

b. Permit panel lifting without racking or distortion.

4. Lifting rings to allow simple, safe rigging and lifting of panel during installation.

5. Adjacent Panels: Securely bolted together so front faces are parallel.

6. Doors: Full height, fully gasketed access doors where shown on Drawings.

a. Latches: Three-point, Southco Type 44.

b. Handles: “D” ring, foldable type.

c. Hinges: Full length, continuous, piano type, steel hinges with stainless steel pins.

d. Rear Access Doors: Extend no further than 24 inches beyond panel when opened to 90-degree position.

e. Front and Side Access Doors: As shown on Drawings.

G. Nonfreestanding Panel Construction:

1. Based on environmental design requirements required and referenced in Article Environmental Requirements, provide the following:

a. Enclosure Type: NEMA 4X in accordance with NEMA 250.

b. Materials: Type 316 stainless steel.

2. Metal Thickness: 14-gauge, minimum.

3. Doors:

a. Rubber-gasketed with continuous hinge.

b. Stainless steel lockable quick-release clamps.

4. Manufacturers:

a. Hoffman Engineering Co.

b. Rittal.

H. Factory Finishing:

1. Enclosures:

a. Stainless Steel: Not painted.

2.09 CORROSION PROTECTION

A. Corrosion-Inhibiting Vapor Capsule Manufacturers:

1. Northern Instruments; Model Zerust VC.

2. Hoffmann Engineering Co; Model A-HCI.

2.10 SOURCE QUALITY CONTROL

A. Scope: Inspect and test entire PIC to ensure it is ready for shipment, installation, and operation.

B. Location: Manufacturer's factory or Engineer approved staging Site.

C. Test: Exercise and test all functions.

D. Temporary PLC software configuring to allow PLC testing.

PART 3 EXECUTION

3.01 EXAMINATION

A. For equipment not provided by PIC, but that directly interfaces with the PIC, verify the following conditions:

1. Proper installation.

2. Calibration and adjustment of positioners and I/P transducers.

3. Correct control action.

4. Switch settings and dead bands.

5. Opening and closing speeds and travel stops.

6. Input and output signals.

3.02 MISSION RTU- MYDRO M150.

A. Install in accordance with Manufacturer's instructions.

B. Retain the service of a specialist to program unit and integrate into controls and the ESD system.

3.03 INSTALLATION

A. Material and Equipment Installation: Retain a copy of manufacturers' instructions at Site, available for review at all times.

B. Electrical Wiring: As specified in Division 26, Electrical.

C. Removal or Relocation of Materials and Equipment:

1. Remove from Site materials that were part of the existing facility but are no longer used, unless otherwise directed by Engineer to deliver to Owner.

2. Repair affected surfaces to conform to type, quality, and finish of surrounding surface.

3.04 FIELD QUALITY CONTROL

A. Startup and Testing Team:

1. Thoroughly inspect installation, termination, and adjustment for components and systems.

2. Complete onsite tests.

3. Complete onsite training.

4. Provide startup assistance.

B. Operational Readiness Inspections and Calibrations: Prior to startup, inspect and test to ensure that entire PIC is ready for operation.

1. Loop/Component Inspections and Calibrations:

a. Check PIC for proper installation, calibration, and adjustment on a loop-by-loop and component-by-component basis.

b. Prepare component calibration sheet for each active component (except simple hand switches, lights, gauges, and similar items).

1) Project name.

2) Loop number.

3) Component tag number.

4) Component code number.

5) Manufacturer for elements.

6) Model number/serial number.

7) Summary of functional requirements, for example:

a) Indicators and recorders, scale and chart ranges.

b) Transmitters/converters, input and output ranges.

c) Computing elements' function.

d) Controllers, action (direct/reverse) and control modes (PID).

e) Switching elements, unit range, differential (fixed/adjustable), reset (auto/manual).

8) Calibrations, for example:

a) Analog Devices: Actual inputs and outputs at 0, 10, 50, and 100 percent of span, rising and falling.

b) Discrete Devices: Actual trip points and reset points.

c) Controllers: Mode settings (PID).

9) Space for comments.

c. These inspections and calibrations will be spot checked by ESD.

C. Performance Acceptance Tests (PAT):

1. General:

a. Test all PIC elements to demonstrate that PIC satisfies all requirements.

b. Test Format: Cause and effect.

1) Person conducting test initiates an input (cause).

2) Specific test requirement is satisfied if correct result (effect) occurs.

c. Procedures, Forms, and Checklists:

1) Conduct tests in accordance with, and documented on, Engineer accepted procedures, forms, and checklists.

2) Describe each test item to be performed.

3) Have space after each test item description for sign off by appropriate party after satisfactory completion.

d. Required Test Documentation: Test procedures, forms, and checklists. All signed by Engineer and Contractor.

e. Conducting Tests:

1) Provide special testing materials, equipment, and software.

2) Wherever possible, perform tests using actual process variables, equipment, and data.

3) If it is not practical to test with real process variables, equipment, and data, provide suitable means of simulation.

4) Define simulation techniques in test procedures.

f. Coordinate PIC testing with Owner and affected Subcontractors.

1) Excessive Test Witnessing: Refer to Supplementary Conditions.

2. Test Requirements:

a. Once facility has been started up and is operating, perform a witnessed PAT on complete PIC to demonstrate that it is operating as required. Demonstrate each required function on a paragraph-by-paragraph and loop-by-loop basis.

b. Perform local and manual tests for each loop before proceeding to remote and automatic modes.

c. Where possible, verify test results using visual confirmation of process equipment and actual process variable. Unless otherwise directed, exercise and observe devices supplied by others, as needed to verify correct signals to and from such devices and to confirm overall system functionality. Test verification by means of disconnecting wires or measuring signal levels is acceptable only where direct operation of plant equipment is not possible.

d. Make updated versions of documentation required for PAT available to Engineer at Site, both before and during tests.

e. Make one copy of O&M manuals available to Engineer at the Site both before and during testing.

f. Refer to referenced examples of PAT procedures and forms in Article Supplements.

3.05 TRAINING

A. General:

1. Provide an integrated training program to meet specific needs of Owner's personnel.

2. Include training sessions, classroom and field, for managers, engineers, operators, and maintenance personnel.

3. Provide instruction on two working shift(s) as needed to accommodate the Owner's personnel schedule.

4. Owner reserves the right to make and reuse video tapes of training sessions.

B. Operations and Maintenance Training:

1. Include a review of O&M manuals and survey of spares, expendables, and test equipment.

2. Use equipment similar to that provided or currently owned by Owner.

3. Provide training suitable for instrument technicians with at least a 2-year associate engineering or technical degree, or equivalent education and experience in electronics or instrumentation.

C. Operations Training:

1. Training Session Duration: One 8-hour instructor days.

2. Number of Training Sessions: Two.

3. Location: Site.

4. Content: Conduct training on loop-by-loop basis.

   a. Loop Functions: Understanding of loop functions, including interlocks for each loop.

   b. Loop Operation: For example, adjusting process variable setpoints, AUTO/MANUAL control transfer, AUTO and MANUAL control, annunciator acknowledgement and resetting.

   c. Interfaces with other control systems.

D. Maintenance Training:

1. Training Session Duration: One 8-hour instructor days.

2. Number of Training Sessions: Two.

3. Location: Project Site.

4. Content: Provide training for each type of component and function provided.

   a. Loop Functions: Understanding details of each loop and how they function.

   b. Component calibration.

   c. Adjustments: For example, controller tuning constants, current switch trip points, and similar items.

   d. Troubleshooting and diagnosis for components.

   e. Replacing lamps, chart paper, fuses.

   f.Component removal and replacement.

   g. Periodic maintenance.

3.06 CLEANING/ADJUSTING

A. Repair affected surfaces to conform to type, quality, and finish of surrounding surface.

B. Cleaning:

1. Prior to closing system using tubing, clear tubing of interior moisture and debris.

2. Upon completion of Work, remove materials, scraps, and debris from interior and exterior of equipment.

3.07 PROTECTION

A. Protect enclosures and other equipment containing electrical, instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules.

B. Periodically replace capsules in accordance with capsule manufacturer's recommendations. Replace capsules just prior to Final Payment and Acceptance.

3.08 SUPPLEMENTS

A. Supplements listed below, following "End of Section," are part of this Specification.

1. Component Specifications.

2. Instrument Calibration Sheet: Provides detailed information on each instrument (except simple hand switches, lights, and similar items).

3. Performance Acceptance Test Sheet: Describes the PAT for a given loop. The format is mostly free form.

a. Lists the requirements of the loop.

b. Briefly describes the test.

c. Cites expected results.

d. Provides space for check off by witness.

END OF SECTION

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COMPONENT SPECIFICATIONS

A. L8 Level Switch, Float, Mercury:

1. General:

a. Function: Actuate contact at preset liquid level.

b. Type: Direct-acting float with enclosed mercury switch and integral cable.

2. Service (Liquid): Wastewater, unless otherwise noted.

3. Performance:

a. Setpoint: As required.

b. Differential: 2.5 inches, maximum.

c. Temperature: 0 degree F to 160 degrees F.

4. Features:

a. Entire Assembly: Watertight and impact-resistant.

b. Float Material and Size:

1) Polypropylene body; 4.5-inch diameter and 6-inch length.

c. Cable:

1) Combination support and signal.

2) Length as noted or as necessary per mounting requirements.

3) PVC cable jacket.

d. Mounting: Pipe, unless otherwise noted.

1) Pipe Mounting:

a) Cable clamp, suitable for connection to 1-inch pipe.

b) Pipe-to-wall bracket, suitable for connection to 1-inch pipe.

2) Suspended Mounting (internal weights): If noted.

a) Wall mounting bracket, unless otherwise noted.

3) Anchor Mounting Kit: If noted.

a) Compatible with pipe-mounted floats.

b) 15-pound vinyl-coated cast iron anchor.

c) 1/8-inch, Type 316 stainless steel vinyl-coated wire rope.

d) Stainless steel cable clips.

5. Signal Interface:

a. Switch Type: Mercury tilt.

b. Switch Contacts:

1) Isolated, rated 4.5A continuous at 120V ac.

2) Form C contact (one NO, one NC), unless otherwise noted.

6. Accessories: As noted.

7. Manufacturers and Products:

a. Anchor Scientific; Roto-Float, S40NO.

B. L52 Level Element/Transmitter, Submersible, Wastewater, Nonfouling:

1. General:

a. Function: Measure and transmit signal proportional to level.

b. Type:

1) Totally submersible pressure sensor (loop powered).

2) Nonfouling.

3) Suitable for wastewater, slurries, and viscous fluids.

c. Parts: Sensor, interconnecting cable, other parts as noted.

2. Service:

a. Fluid: Wastewater, unless otherwise noted.

3. Performance:

a. Process Range:

1) As required.

2) Provide fixed factory range such that noted process range is between 40 percent and 80 percent of fixed factory range.

b. Accuracy: 0.25 percent of full scale.

c. Temperature, Operating: Minus 4 degrees F to plus 140 degrees F.

d. Overpressure:

1) Proof: At least 1.5 times full scale.

2) Burst: At least 2.0 times full scale.

4. Features:

a. Sensor:

1) Silicon pressure-sensing element.

2) Type 316 stainless steel pressure module assembly.

3) Other Wetted Materials: Teflon.

4) NEMA 6/IP 68 rating (submersible).

5) Temperature compensation.

6) Sensing Area: 2.75-inch diameter.

7) Integral diaphragm protector.

8) Dimensions, Nominal:

a) Pressure-Sensing Assembly: 1-inch diameter.

b) Sensing Area Assembly: 4-inch diameter.

c) Length (without integral lightning protector): 8 inches.

9) Nominal Weight: 3.5 pounds.

10) Loop powered, 9-30V dc.

b. Interconnecting Cable:

1) Length: As required.

2) Polyurethane sheathed, unless otherwise noted.

3) Kevlar strain relief cord.

4) Integral vent tube.

c. Sensor Termination Enclosure: Required, unless otherwise noted.

1) Enclosure: NEMA 4X.

2) Houses such noted items as desiccant vent, filter, microfilter, aneroid bellows.

d. Accessories:

1) Aneroid Bellows: If noted.

a) Bellows shall be suitable for application.

2) Desiccant Module: Required, unless otherwise noted.

3) Spare desiccant modules: If noted.

a) Quantity: As noted.

4) Cable Hanger, Kellems Type Grip: Required, unless otherwise noted.

5) Lightning Protection:

a) Internal (protects against water lightning strike): Required, unless otherwise noted.

b) External (protects 4 mA to 20 mA dc output): Required, unless otherwise noted.

5. Signal Interface: 4 mA to 20 mA dc output, for load impedance of 0 ohm to 750 ohms, minimum for 24V dc supply without load adjustment.

6. Electrical Connection: 1/2-inch, 14 NPT male conduit fitting with molded cable seal, unless otherwise noted.

7. Certification(s):

a. Class I, Div 1, Groups A, B, C, and D.

b. Class II, Div 1, Groups E, F, and G.

c. Class III, Div 1.

8. Manufacturer and Model: Esterline; Mercoid SBLT2-5-40.

END OF COMPONENT SPECIFICATIONS

INSTRUMENT CALIBRATION SHEET Rev.06.05.92

COMPONENT	**MANUFACTURER**	**PROJECT**
Code:	Name:	Number:
Name:	Model:	Name:
	Serial #:	

FUNCTIONS

	RANGE	VALUE	UNITS	COMPUTING FUNCTIONS? Y / N	CONTROL? Y / N
Indicate? Y / N	Chart:			Describe:	Action? direct / reverse Modes? P / I / D
Record? Y / N	Scale:				SWITCH? Y / N Unit Range:
Transmit/	Input:				Differential: fixed/adjustable
Convert? Y / N	Output:				Reset? automatic / manual

ANALOG CALIBRATIONS							**DISCRETE CALIBRATIONS**					**Note**
REQUIRED			AS CALIBRATED				REQUIRED			AS CALIBRATED		**No.**
Input	Indicated	Output	Increasing Input		Decreasing Input		Number	Trip Point	Reset Pt.	Trip Point	Reset Pt.	
			Indicated	Output	Indicated	Output		(note rising or falling)		(note rising or falling)		
							1.					
							2.					
							3.					
							4.					

							5.						
							6.						
CONTROL MODE SETTINGS:			P:	I:	D:		7.						

#	NOTES:	Component Calibrated and Ready for Startup
		By:
		Date:
		Tag No.:

INSTRUMENT CALIBRATION SHEET Rev.06.05.92

EXAMPLE - ANALYZER/TRANSMITTER

COMPONENT	**MANUFACTURER**	**PROJECT**
Code: *A7*	Name: *Leeds & Northrup*	Number: *WDC30715.B2*
Name: *pH Element & Analyzer/Transmitter*	Model: *12429-3-2-1-7*	Name: *UOSA AWT PHASE 3*
	Serial #: *11553322*	

FUNCTIONS

	RANGE	VALUE	UNITS	COMPUTING FUNCTIONS? N	CONTROL? N
Indicate? Y Record? N	Chart:			Describe:	Action? direct / reverse Modes? P / I / D
	Scale:	*1-14*	*pH units*		SWITCH? N Unit Range:
Transmit/	Input:	*1-14*	*pH units*		Differential: fixed/adjustable
Convert? Y	Output:	*4-20*	*mA dc*		Reset? automatic / manual

ANALOG CALIBRATIONS							**DISCRETE CALIBRATIONS**					**Note**
REQUIRED			AS CALIBRATED				REQUIRED			AS CALIBRATED		**No**
Input	Indicated	Output	Increasing Input		Decreasing Input		Number	Trip Point	Reset Pt.	Trip Point	Reset Pt.	
			Indicated	Output	Indicated	Output		(note rising or falling)		(note rising or falling)		
1.0	*1.0*	*4.0*	*1.0*	*4.0*	*1.0*	*3.9*	1.	*N.A.*		*N.A.*		
2.3	*2.3*	*5.6*	*2.2*	*5.5*	*2.3*	*5.6*	2.					*1.*

7.5	*7.5*	*12.0*	*7.5*	*11.9*	*7.5*	*12.0*	3.					
12.7	*12.7*	*18.4*	*12.7*	*18.3*	*12.6*	*18.3*	4.					
14.0	*14.0*	*20.0*	*14.0*	*20.0*	*14.0*	*20.0*	5.					
							6.					
CONTROL MODE SETTINGS:			P: *N.A.*	I:	D:		7.					

#	**NOTES:**	**Component Calibrated and Ready for Startup**
	1. Need to recheck low pH calibration solutions.	By: *J.D. Sewell*
		Date: *Jun-6-92*
		Tag No.: AIT-12-6[pH]

I&C VALVE ADJUSTMENT SHEET

Rev.06.05.92

PARTS	Project Name:	Project Number:
Body	Type:	Mfr:
	Size:	Model:
	Line Connection:	Serial #:
Operator	Type:	Mfr:
	Action:	Model:
	Travel:	Serial #:
Positioner	Input Signal:	Mfr:
	Action:	Model:
	Cam:	Serial #:
Pilot	Action:	Mfr:
Solenoid	Rating:	Model:
		Serial #:
I/P	Input:	Mfr:
Converter	Output:	Model:
	Action:	Serial #:
Position	Settings:	Mfr:
Switch	Contacts:	Model:
		Serial #:
Power	Type:	Air Set Mfr:
Supply	Potential:	Model:

		Serial #:

ADJUSTMENTS	Initial	Date	**VERIFICATION**	Initial	Date
Air Set			Valve Action		
Positioner			Installation		
Position Switches			Wire Connection		
I/P Converter			Tube Connection		
Actual Speed					

REMARKS:	**Valve Ready for Startup**
	By:
	Date:
	Tag No.:

I&C VALVE ADJUSTMENT SHEET Rev.06.05.92

EXAMPLE

PARTS	Project Name: *SFO SEWPCP*	Project Number: *SFO10145.G2*
Body	Type: *Vee-Ball*	Mfr: *Fisher Controls*
	Size: *4-inch*	Model: *1049763-2*
	Line Connection: *159 # ANSI Flanges*	Serial #: *1003220*
Operator	Type: *Pneumatic Diaphragm*	Mfr: *Fisher Controls*
	Action: *Linear - Modulated*	Model: *4060D*
	Travel: *3-inch*	Serial #: *2007330*
Positioner	Input Signal: *3-15 psi*	Mfr: *Fisher Controls*
	Action: *Direct - air to open*	Model: *20472T*
	Cam: *Equal percentage*	Serial #: *102010*
Pilot	Action:	Mfr:
Solenoid	Rating: *None*	Model:
		Serial #:
I/P	Input: *4-20 mA dc*	Mfr: *Taylor*
Converter	Output: *3-15 psi*	Model: *10-T-576-3*
	Action: *Direct*	Serial #: *1057-330*
Position	Settings: *Closed / Open 5 deg, rising*	Mfr: *National Switch*
Switch	Contacts: *Close / Close*	Model: *1049-67-3*
		Serial #: *156 &157*
Power	Type: *Pneumatic*	Air Set Mfr: *Air Products*
Supply	Potential: *40 psi*	Model: *3210D*
		Serial #: *1107063*

ADJUSTMENTS	Initial	Date	**VERIFICATION**	Initial	Date
Air Set	*JDS*	*Jun-06-92*	Valve Action	*JDS*	*Jun-03-92*
Positioner	*JDS*	*Jun-06-92*	Installation	*JDS*	*Jun-03-92*
Position Switches	*JDS*	*Jun-06-92*	Wire Connection	*JDS*	*Jun-04-92*
I/P Converter	*JDS*	*Jun-07-92*	Tube Connection	*JDS*	*Jun-04-92*
Actual Speed	*JDS*	*Jun-07-92*			

REMARKS: *Valve was initially installed backwards.*	**Valve Ready for Startup**
Observed to be correctly installed May-25-92	By: *J.D. Sewell*
	Date: *Jun-07-92*
	Tag No.: *FCV-10-2-1*

PERFORMANCE ACCEPTANCE TEST SHEET ***Rev.06.05.92***

Project Name:	Project No.:

Demonstration Test(s): For each functional requirement of the loop:
(a) List and number the requirement. (b) Briefly describe the demonstration test.
(c) Cite the results that will verify the required performance. (d) Provide space for signoff.

Forms/Sheets Verified	By	Date	**Loop Accepted By Owner**
Loop Status Report			By:
Instrument Calibration Sheet			Date:
I&C Valve Calibration Sheet			
Performance Acceptance Test	By	Date	
Performed			
Witnessed			Loop No.:

PERFORMANCE ACCEPTANCE TEST SHEET **Rev.06.05.92**

EXAMPLE

Project Name: *SFO SEWPCP Plant Expansion*	Project No.: *SFO12345.C1*

Demonstration Test(s): For each functional requirement of the loop:
(a) List and number the requirement. (b) Briefly describe the demonstration test.
(c) Cite the results that will verify the required performance. (d) Provide space for signoff.

1. MEASURE EFFLUENT FLOW

1.a With no flow, water level over weir should be zero and

FIT indicator should read zero. *Jun-20-92 BDG*

2. FLOW INDICATION AND TRANSMISSION TO LP & CCS

With flow, water level and FIT indicator should be related by expression

*Q(MGD) = 429*H**(2/3) (H = height in inches of water over weir).*

Vary H and observe that following.

2.a Reading of FIT indicator. *Jun-6-92 BDG*

2.b Reading is transmitted to FI on LP-521-1. *Jun-6-92 BDG*

2.c Reading is transmitted and displayed to CCS. *Jun-6-92 BDG*

H(measured)	*0*	*5*	*10*	*15*
Q(computed)	*0*	*47.96*	*135.7*	*251.7*
Q(FIT indicator) 0	*48.1*	*137*	*253*	
Q(LI on LP-521-1)	*0*	*48.2*	*138*	*254*
Q(display by CCS)	*0*	*48.1*	*136.2*	*252.4*

Forms/Sheets Verified	By	Date	**Loop Accepted By Owner**
Loop Status Report	*J.D. Sewell*	*May-18-92*	By: *J.D. Smith*
Instrument Calibration Sheet	*J.D. Sewell*	*May-18-92*	Date: *Jun-6-92*
I&C Valve Calibration Sheet	*N.A.*		
Performance Acceptance Test	By	Date	
Performed	*J. Blow MPSDC Co.*	*Jun-6-92*	
Witnessed	*B.deGlanville*	*Jun-6-92*	Loop No.: *30-12*

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SECTION 40 91 23.35
ELECTROMAGNETIC FLOWMETER

PART 1 - GENERAL

1.1 SCOPE

A. This section describes the requirements for an electromagnetic flow meter and microprocessor-based signal converter. Under this item, the contractor shall furnish and install the flowmeter equipment and accessories as indicated on the plans and as herein specified.

1.2 SUBMITTALS

A. The following information shall be included in the submittal for this section:
   1. Data sheets and catalog literature for the flowmeter and the microprocessor-based signal converter.
   2. Connection diagrams for equipment wiring.
   3. List of spare parts and optional equipment.

PART 2 - PRODUCTS

2.1 ELECTROMAGNETIC FLOWMETER (MAGMETER)

A. The electromagnetic flow meter shall consist of a flow sensor based on Faraday's Law of Electromagnetic Induction and microprocessor-based signal converter. Sensor and converter shall have same manufacturer.

B. Sensor and Converter:
   1. Operating principle: Utilizing Faraday's Law of Electromagnetic Induction, the flow of liquid through the sensor induces an electrical voltage that is proportional to the velocity of the flow.
   2. Construction: The sensor flow tube and liner material shall be constructed of a composite elastomer (hard and soft rubber) surrounded by two integral coils. Measurement and grounding electrodes shall be 316 stainless steel. Connecting flanges shall be carbon steel.
   3. Installation: Generally, a minimum of five (5) pipe diameters upstream and two (2) pipe diameters downstream are recommended. The Contractor shall verify installation recommendations with the manufacturer.
   4. Operating Temp: -20 to +160° F.
   5. Size: 1" to 48" diameter (see instrument schedule)

6. Submergence: The sensor shall be pedestal sealed against accidental submersion to 3 feet for 30 minutes standard, or permanently submerged to 30 feet when the terminal box is backfilled with a non-setting, transparent potting material.

7. Enclosure: NEMA 4X enclosure

8. Display: Background illumination with alphanumeric 3-line, 20-character display to indicate flow rate, totalized values, settings, and faults.

9. Power supply: 115/230 VAC or 11-24VDC.

10. Outputs: 0-20 mA or 4-20 mA into 800 ohms max. One relay rated at 42 VAC/2 A, 24 DC/1 A. Digital (frequency or pulse) for external display of flow rate or totalizer.

11. Communications: Optional HART available.

12. Sensor and signal converter performance:

    a. Flow Range: 1 fps to 39 fps for accuracies stated below.

    b. Accuracy: 0.5% of actual flow.

    c. Separation: Maximum distance of 900 feet between signal converter and sensor without the use of any additional equipment.

    d. Bi-directional flow capabilities shall be standard

13. Totalizer: Two eight-digit counters for forward, net, or reverse flow

14. The electromagnetic flow meter shall be manufactured by Siemens, Rosemount, McCrometer, ABB or approved equal.

2.2 SPARE PARTS

A. Spare parts for the equipment shall include the following, unless otherwise noted:

B. One set of manufacturers recommended spare parts.

C. Extra operation manuals as required.

2.3 OPERATOR FUNCTIONS

A. Calibration

1. Each flow sensor shall be wet calibrated and all of the calibration information and factory settings matching the sensor shall be stored in an integrally mounted memory unit. The memory unit shall store sensor calibration data and signal converter settings for the lifetime of the product. At initial commissioning, the flowmeter commences measurement without any initial programming. Any customer specified settings are downloaded to the memory unit. Should the

signal converter need to be replaced, the new signal converter will upload all previous settings and resume measurement without any need for reprogramming or rewiring.

2. A certificate of calibration shall accompany each flow sensor.

2.4 SIGNAL CONVERTER FUNCTION DETAILS

A. The following functions shall be provided:

1. All programming shall be accomplished through an integral keypad and all programming shall be protected by a user-defined password.

2. The signal converter shall be integrally mounted or remotely mounted using a remote-mount kit provided by the manufacturer.

3. The signal converter shall provide a 0/4-20 mA DC signal proportional to flow rate into 800 ohms max. Output selectable as unidirectional or bi-directional.

4. The relay shall be programmable as error indicator, limit alarm or pulsed output.

5. The signal converter system shall be equipped with an error and status log with 4 groups of information.

   a. Information without a functional error involved.

   b. Warnings which may cause malfunction in the application

   c. Permanent errors, which may cause malfunction in the application.

   d. Fatal error, which is essential for the operation of the flowmeter.

6. A system error shall be indicated by a flashing icon on the display or activation of the relay when set as an error alarm.

7. The first nine standing errors shall be stored in the error pending log. A corrected error is removed from the error pending log. A status log shall be provided to store the last 9 error messages received for 180 days regardless of correction.

2.5 REVERIFICATION

A. Verification

1. A factory verification service shall be utilized to measure a number of selected parameters in the flow sensor and signal converter, which affects the integrity of the flow measurement.

2.6 PARAMETERS

A. Verification of the Flowmeter shall consist of the following test routines:

1. Insulation test of the entire flowmeter system and cables.

2. Test of sensor magnetic properties.

3. Signal converter gain, linearity, and zero point tests.

4. Digital output test.

5. Analog output test.

2.7 CERTIFICATE

A. A certificate of verification shall be issued if the flowmeter passes all of the tests within 1% of the original factory test parameters.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Follow manufacturer's recommendation for the minimum upstream and downstream installation requirements for the flow sensor.

B. Wiring between flow sensors and remote mounted signal converters shall use cable type and procedures per the manufacturers' recommendations. Provide length as required for distance to remote signal converter.

3.2 MANUFACTURER'S ASSISTANCE

A. Warranty

1. The manufacturer of the electromagnetic flow meter shall guarantee for one year of operation that the equipment shall be free from defects in design, workmanship, or materials.

2. In the event a component fails to perform as specified, or is proven defective in service during the guarantee period, the manufacturer shall promptly repair or replace the defective part at no cost to the owner.

END OF SECTION

SECTION 40 92 13
MOTORIZED OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Motorized gate and valve operators and mechanical, gear type limit switches.

B. Related sections:
   1. Section 01 33 00 – Submittal Procedures.
   2. Section 01 60 00 – Product Requirements.
   3. Section 40 27 20 – Valves and Operators.

1.2 REFERENCES

A. American Water Works Association (AWWA).

B. National Electrical Manufacturer's Association (NEMA)

1.3 SUBMITTALS

A. Submittals shall be made as required in Section 01 33 00, SUBMITTALS of Division 01, GENERAL REQUIREMENTS. The following specific information shall be provided:
   1. Design Data:
      a. Product data sheets for make and model.
      b. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
      c. Operating torque calculations for each valve size and class.
      d. Maximum starting and normal operating torques for the operators supplied. Size operator for maximum starting torque.
   2. Quality Control Submittals:
      a. Tests and inspection data.
      b. Manufacturer's Certificate of Proper Installation.
      c. Manufacturer's printed installation instructions.
      d. Special shipping, storage and protection, and handling instructions.
      e. Suggested spare parts list to maintain the equipment in service for a period of 5 years. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
      f. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.

1.4 QUALITY ASSURANCE

A. Ascertain that the valve manufacturer provides limit switches with the valves.

B. Actuator/operator manufacturer shall coordinate with the valve manufacturer and submit calculations showing the maximum and normal operating torques for the valves and operators supplied.

PART 2 - PRODUCTS

2.1 MOTORIZED OPERATOR

A. Manufacturers: Motorized operators for gates and valves shall be the product of a single supplier for each type of gate or valve. Products shall be furnished by one of the following, or engineer approved equal:
   1. AUMA
   2. Rotork
   3. Limitorque Company, Model MX.
   4. EIM Company.

B. Design:
   1. Sized to move gates or valves from full open to closed position at minimum 12 inches per minute, plus or minus 10 percent, under maximum load.
      a. Measure rate of closure for butterfly valve discs at disc edge on diameter at right angle to valve shaft.
   2. Actuator: Provide with built-in device to allow motor to reach full speed before engaging valve load; in manual operating mode when motor is not energized; in electrical operating mode when motor is energized.
   3. Handwheels for Manual Operation: Metallic with arrows to indicate “open” rotation; incapable of rotation during motor operation; unaffected by fused motor; maximum 80 pound pull on rim when rotating.
   4. Declutch Lever: Padlockable, capable of mechanically disengaging motor and related gearing positively when motor is deenergized and freeing handwheel for manual operation.

C. Actuator Gearing:
   1. Valve Actuator Gearing: Multiple reduction type with hardened alloy steel spur or helical gears and self-locking, alloy bronze worm gear set in drive train to maintain valve position.
   2. Gate Actuator Gearing: Multiple reduction type with hardened alloy steel spur gear, bevel pinion and bevel gears; self-locking to maintain gate position.
   3. Power Gearing: Hardened alloy steel; accurately cut to assure minimum backlash; anti-friction bearing with caged balls or rollers throughout.
   4. Stem Nuts: High tensile manganese bronze; accurately machined and mounted in heavy ball or roller bearings; minimum 2-1/4 times stem diameter for length of thread in lift nuts.
   5. Actuator Gear Housing: Ductile iron.
   6. Lubrication: Rotating power train components immersed in grease with provisions for inspection and re-lubrication without disassembly.

a. Lubricants: Suitable for ambient conditions of minus 20 degrees Fahrenheit to plus 150 degrees Fahrenheit.
b. Provide seals on shafting.

D. Motors:
1. Type: Specifically designed for valve actuator service with high starting torque, totally enclosed non-ventilated construction.
2. Motor Insulation: Minimum NEMA Class F, with a maximum continuous temperature rating of 155 degrees Centigrade, rise plus ambient.
3. Motor Windings: Epoxy treated.
4. Size: Sufficient to open and close valves at maximum stated torque.
5. Voltage Tolerance: Capable of operating at within 10 percent of specified voltage.
6. Motor Duty Ratings: 15 minute duty rating for open and close service; continuous duty rating for modulating service.
7. Accessories: Internal thermal contacts, heaters in motor and switch compartment, and ground lug.
8. Power Supply: As scheduled or as indicated on the Drawings.
9. Enclosures for Motors, Switches, and Other Electrical Compartments:
a. Where explosion-proof construction is indicated on the Drawings, provide NEMA 7 enclosures.
b. Other Locations: Provide NEMA 4X enclosures.

E. Controls:
1. Voltage Transformer: As required to step down power supply to control voltage.
2. Control Station:
a. Integral with operator or mounted in separate enclosure.
1) Where explosion-proof construction is indicated on the Drawings, provide NEMA 7 enclosure.
2) For other locations, provide NEMA 4X enclosure.
b. Provide with additional contacts for remote indication of hand switch position where indicated on the Drawings.
c. Provide with the following devices:
1) Lock-out ON-OFF-REMOTE selector switch.
2) OPEN, STOP, CLOSE pushbuttons.
3) OPEN and CLOSE indicating lights.
3. Limit switches and associated gearing shall be integral with valve actuator.
a. Gearing: Intermittent type; bronze or stainless steel; grease lubricated; totally enclosed.
b. Contacts: Heavy duty and silver plated with wiping action.
c. Remote Indication Contacts: As indicated on the Drawings.
d. Switches: Adjustable; allowing for trip points from fully open to closed positions of valve travel; not subject to breakage or slippage due to over-travel; permits visible verification of switch position without disassembly.
4. Torque Limit Switch:
a. Capable of interrupting control circuit in both opening and closing when valve torque overload occurs.

b. Silver plated contacts.
c. Graduated dials for both open and close directions of travel, each independently adjustable.
d. Positive means to limit adjustability to avoid exceeding actuator output torque capability with Belleville activating spring pack.
e. Permits visible verification of switch position without disassembly.

F. Operation:
1. Open-Close Service:
a. Operators shall operate automatically by remote signal specified and as indicated on the Drawings.
b. When the selector switch is in the REMOTE position, the self-contained electromechanical reversing starter shall cause valve or gate to open or close on receiving a remote signal.
c. When the selector switch is in the ON position, the local control station will control the motorized operator.
2. Modulating Service:
a. Actuator Controller: Microprocessor based and using proportional-integral derivative algorithm to calculate actuator response.
b. Controller shall compare 4 to 20 milliampere direct-current analog command signal to analog feedback signal and move actuator accordingly.
c. A microprocessor-based controller shall control the integrally mounted solid state reversing starter.
3. Where indicated on the Drawings, provide 4 to 20 milliampere direct-current analog output signal for continuous remote monitoring of position.
4. Controller System: Rated for continuous duty.

G. Valve Limit Switches:
1. Type: Mechanical cam gear for remote operation, indication, and other control; compatible with associated operation and suitable for service intended; for valves specified and indicated on the Drawings; with racks, gears, cam, linkage mountings, and accessories.
2. Mechanical Limit Switches: 2-pole, 3-pole, or 4-pole; gang-mounted in required multiples, and with necessary mechanical linkage.
3. Contact Ratings: 120 volt alternating current, 20 amperes at 75 to 100 percent power factor, and 24 volt direct current, 5 amperes minimum.
4. Enclosures: Watertight and oiltight for normal service.
5. Valve box: Large enough to contain and to allow easy adjustment of limit switch without switch's removal.

PART 3 - EXECUTION

3.1 SHIPPING, STORAGE, HANDLING, AND PROTECTION

A. As specified in Section 01 60 00, PRODUCT REQUIREMENTS.

3.2 INSTALLATION

A. Install operators in accordance with Manufacturer's instructions.

B. Locate valve boxes where indicated on the Drawings.

END OF SECTION

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DIVISION 41

MATERIAL PROCESSING AND HANDLING EQUIPMENT

SECTION 41 31 13.53
CARBON ODOR CONTROL SYSTEM

PART 1 – GENERAL

1.1 SCOPE

A. Furnish all labor, materials, equipment and incidentals required to install a complete odor control system for the control of atmospheric hydrogen sulfide (H_2S) and other noxious odors as shown on the drawings and specified herein.

B. The system shall include the following components:
1. Carbon Adsorber Vessel
2. Activated Carbon and polishing media
3. Fan and Motor Assembly
4. Instruments
5. System Accessories
6. Fan enclosure
7. Outlet silencer
8. Prefilter
9. Control Panel

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.3 REFERENCES

A. ASTM International
1. D2563, Standard Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts.
2. D2584, Standard Test Method for Ignition Loss of Cured Reinforced Resins.
3. D2854, Standard Test Method for Apparent Density of Activated Carbon.
4. D 2867, Standard Test Methods for Moisture in Activated Carbon.
5. D3299, Standard Specifications for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks.
6. D3467, Standard Test Method for Carbon Tetrachloride Activity of Activated Carbon.
7. D3802, Standard Test Method for Ball-Pan Hardness for Activated Carbon.
8. D4097, Standard Specification for contact-molded glass-fiber-reinforced Thermoset Resin Corrosion-Resistant Tanks.
9. D3982, flanges

B. National Bureau of Standards (NBS) PS 15-69, Custom molded reinforced polyester for chemical resistant process equipment

1.4 SUBMITTALS

A. Submittals shall be in accordance with Division 01 GENERAL REQUIREMENTS, Section 01 33 00 SUBMITTAL PROCEDURES, and include as a minimum the following items:

1. Vessel fabrication details and materials of the components shall be included in shop drawings, and submitted for approval before fabrication.
2. Carbon Specifications: Furnish within 30 days after contract execution, a certificate from the carbon manufacturer certifying that the proposed activated carbon will meet the carbon media specifications. Provide a 1-gallon representative carbon sample and specification sheet of the carbon that will be provided.
3. Catalog information, descriptions, specifications layouts, sketches and other information sufficient to clearly and readily demonstrate compliance with all parts of the specifications and drawings.
4. Calculations showing theoretical anticipated life of carbon media, based on anticipated average hydrogen sulfide concentrations.
5. Dimensional and weight information. Include empty weight and operating weight with carbon.
6. A list of ten recent installations where similar equipment by the manufacturer is currently in service; include contact name, telephone number, mailing address, and the names of the engineer, owner, and installation contractor. Additionally a list of similar installations shall be provided that shows the supplier has experience in carbon adsorption systems in odor control applications.
7. Resin manufacturer's certificate listing the nomenclature, composition, and characteristics of the resin shall be furnished with the vessel if the vessel is constructed of fiberglass-reinforced plastic (FRP).
8. Letter from the resin manufacturer stating recommended corrosion liner for service outlined in this specification.
9. Activated carbon manufacturer's certificate and statement of origin.
10. Vessel fabricator's certificate of compliance with fabrication requirements.
11. Copy of fabricator's quality assurance (QA) program.
12. Special shipping, storage, and protection, and handling instruct ruction.
13. Suggested spare parts list to maintain the equipment in service for a period of 1 year.
14. List of major component suppliers including the fan, fiberglass vessel, fiberglass prefilter, prefilter pad, media, silencer and control panel. List shall include vendor location and contact information in the event inspection is required.

1.5 QUALITY ASSURANCE

A. The system supplier shall have experience in carbon adsorption systems in wastewater facilities' odor control applications, demonstrating at least 10 years' experience fabricating similar odor control systems. Experience shall be specific to process design, no FRP vessel fabrication.

B. Fabricator's QA Supervisor: Minimum of 3 years' experience in fabrication of fiberglass structures and similar packaged odor control systems.

1.6 NFPA 820

A. The system shall be designed and fabricated in compliance with the National Fire and Protection Agency Code 820. The vessel and ductwork shall be manufactured using a vinyl resin system that achieves a Class I flame spread rating. The resin system shall be AOC K022, or equal.

B. The local control panel will be mounted remotely from the adsorber system and shipped separately. The installation and wiring of the remote-mounted control panel to the fan will be the responsibility of the Contractor.

PART 2 – PRODUCTS

2.01 GENERAL

A. The system supplier shall furnish all of the items required to provide a properly functioning system for the service conditions listed herein.

B. The products shall be the end products of one responsible system supplier in order to achieve standardization of appearance, operation, maintenance, spare parts, and manufacturer's services. Basis of design is the 60 Series V1-800-CST from ECS Environmental Solutions.

2.02 SYSTEM SUPPLIERS

A. ECS Environmental Solutions

B. Purafill.

2.03 SERVICE CONDITIONS

A. The odor control system shall be designed to remove the odorous constituents from the process air stream under the following operating conditions:

Process Parameter	Value
Duty	Continuous
Elevation Above Sea Level	516.00 +/- feet
Location	Outdoors
Inlet Air Temp	40 to 120 degrees F
Inlet Relative Humidity	30% to 90%
Total Air Volume	200 cfm
Removal Required, Odor	90%
Removal Required, H2S	H_2S: 99% removal

B. The carbon vessel shall conform to the following parameters:

Process Parameter	Value
Vessel Type	Single Bed / Top Mounted Fan
Vessel Material of Construction	FRP
Airflow	200 cfm
Pressure Drop (Max)	Vessel (Inlet to Outlet): 6" w.c.
Media Volume Supplied	15 CF initial supply
Vessel Actual Media Capacity	15 CF
Vessel Dimensions	Inside diameter (min): 30"
Pressure Rating	+/- 10" w.c.

2.04 ADSORBER VESSEL

A. The FRP adsorber vessel shall be filament-wound, manufactured in accordance with ASTM D3299. The visual defects, per ASTM D2563, shall not exceed Level II on the vessel interior and Level III on the vessel exterior. The resin used shall be Dow 510, AOC K022, or approved equal suitable for continuous exposure to saturated water vapor, hydrogen sulfide gas, and their associated acidic products. The resin system should provide a class 1 flame spread rating. Antimony, Nyacol or any other additives are not allowed. A permanent wax containing resin coating, formulated according to the resin manufacturer's most recent recommendations (or other Engineer-approved

method) shall be used for surface protection and to prevent air inhibition of resin curing. Contact molded accessories shall be manufactured in accordance with NBS PS15. The completed vessel shall be translucent until it is gel coated. The final gel coat color shall be selected by the owner or engineer. A certificate from the resin manufacturer listing the nomenclature, composition, and characteristics of the resin shall be furnished with the vessel.

1. An inner corrosion barrier shall be provided consisting of no less than three laminated layers. The inner corrosion layer shall be resin rich, not to exceed 20 percent plus or minus 5 percent glass by weight, and a minimum thickness of 10 to 15 mils. The inner corrosion layer shall be followed by at least two layers of chopped-strand mat or two passes of chopped roving to a total of 3 ounces per foot. Should the chopped roving technique be employed, the chopped fibers shall be 1/2 inch to 2 inches in length. The total corrosion barrier shall total 100 mils minimum and be 27 percent plus or minus 5 percent glass by weight.
2. The structural aspects of the vessel shall be sufficient to meet recommended requirements, including seismic requirements for all conditions during the design life. Manufacturer shall include with the shop drawings, detailed calculations illustrating the seismic characteristics of the proposed vessels. Calculations shall be signed and stamped by a registered mechanical engineer.
3. In addition to the above requirements, the adsorber vessel shall have an average glass content of 55 percent plus or minus 5 percent by weight per ASTM D2584.
4. Tie down lugs and lifting lugs shall be 316 stainless steel.
5. The adsorber vessel shall be complete with integral carbon screen support structure, access manways, air inlet connection, air outlet, no-loss discharge stack, pressure differential assembly, a fill connection, a drain connection, sample port nozzles, 316 stainless grounding rod and all necessary accessories as shown on the Drawings and/or specified within. All exhaust air shall leave the vessel at the top. Provide sufficient access manway so that all internal parts can be easily removed from the vessel. All metal parts shall be Type 316 stainless steel with no metallic parts contacting the carbon except for grounding purposes.
6. Access manway covers shall be airtight at the pressure equal to or higher than the corresponding fan static pressure. The fabrication details and materials of the components shall be included in shop drawings, and submitted for approval before fabrication.
7. Vessel design and airflow configuration shall be furnished to accommodate a single bed activated carbon layer.
    a. Single Bed Requirements:
        i. The bed and vessel configuration is to be conducive to easy carbon replacement.
        ii. The bed shall be supported on a polypropylene screen and fiberglass grating.
        iii. Screen and grating must be removable through access and manway.

iv. The grating and its support ledge shall be capable of supporting the load imposed by the depth of activated carbon specified, plus a person load of 200 pounds located anywhere on the grating.

v. No pultruded parts are allowed on the interior of the vessel. Carbon support beams, structure or otherwise shall all be manufactured using the same resin as specified in the vessel construction. All components shall have a 100-mil corrosion barrier applied to any surfaces exposed to the corrosive airstream.

8. Each activated carbon bed shall be grounded with a 316 stainless steel rod to prevent static electricity from accumulating. Connection to grounding system will be with a 10 gauge wire.
9. All cut-walls from tank wall nozzle cutouts shall be reinforced as required by service conditions. Press molded or compression molded flanged nozzles are not acceptable.
10. Add ultraviolet absorbers to surfacing to improve weather resistance.
11. No dyes, pigments or colorants except in exterior gel coating.

2.05 ACTIVATED CARBON MEDIA

A. The high capacity, activated carbon shall be virgin, pelletized, derived from high grade bituminous coal or coconut shell, suitable for the control of sewage odors. The carbon shall have the following specifications:

B. SPECIFICATIONS:

Coal Type	Bituminous or Coconut Shell
MPD,mm	4.0 – 4.25
Apparent Density,g/cc	0.40 - 0.425
Hardness No.	95 min
CTC Activity	60 min
CTC Retentivity, wt %	22 -25
H_2S Capacity, gH_2S/cc[1]	0.30 minimum

[1] The determination of H2S breakthrough capacity will be made by passing a moist (85% R.H.) air stream containing 1% H2S at a rate of 1,450 cc/min. through a 1 inch diameter by 9 inch deep bed of uniformly packed activated carbon and monitored to 50 ppm breakthrough. Results are expressed in grams H2S removed per cc of carbon. Test shall be performed per ASTM Test method D-6646, without modification or addition.

C. INSTALLATION

1. Vessel shall be supplied with an initial media supply; Owner will also receive a media refill supply equal to the initial supply.
2. Initial supply shall be equal to 2 V.F. of high capacity carbon and 1 V.F. of potassium permanganate impregnated media to serve as a polishing agent. The polishing agent media should have 10% active ingredient by weight as a minimum.

2.06 FAN

A. The fan shall be a centrifugal industrial fan of aluminum and epoxy coated construction. Wheel shall be aluminum forward curved electrically and dynamically balanced. All parts of the fan that are exposed to the airstream shall be encapsulated in FRP with graphite impregnation to insure corrosion resistance and spark proof operation.

B. All fans shall be equipped with the following features and accessories:
1. Arrangement 4HM
2. Fan Mounted on vessel lid
3. Fan outlet damper

C. Fan shall be manufactured by Cincinnati Fan or NYB

D. The fan shall be rated for 800 cfm @ 6" w.c.

2.07 SOUND ATTENUATION PACKAGE

A. A FRP sound enclosure and outlet silencer shall be provided by the system supplier. Construction and performance shall be as follows:
1. Walls shall be vacuum-formed construction with two layers of FRP over a honey-comb core.
2. Resin, liner, color and exterior coating system shall be the same as specified for the adsorber vessel.
3. Enclosure shall have four ventilation louvers installed.
4. Enclosure shall be manufactured so that it can be easily removed for maintenance.
5. Enclosure shall be single-piece construction. No seams or joints are allowed. Bolt-together kit enclosures are not acceptable.
6. Enclosure shall have 2" of sound-attenuating lining on all internal surfaces.
7. Performance of the enclosure design should produce a 20 Db insertion loss at 3'.

2.08 INSTRUMENTATION

A. Pressure differential instruments shall be provided and include Magnehelic style pressure gauges allowing determination of the pressure loss in inches of water column

across the carbon. The range shall be 0-10 inches of water. Tubing shall be bonded to a solid acrylic plastic block that contains safety traps. Differential pressure gauge shall be Dwyer or equal.

B. Sampling Ports: Each adsorption unit shall have three 2-inch diameter sample ports which extend into the carbon bed 1 foot minimum, suitable for extracting carbon samples. Provide one grain thief that is capable of extracting a core sample of the in-place carbon through the sample ports. Ports shall be adequate to provide suitable extraction of air samples from the carbon bed and be nonbinding. Each port nozzle shall extend outside the vessel wall and be blocked off with a 2-inch ball valve. One additional air sampling port shall be provided above the carbon bed.

2.09 CONTROLS

A. Control Panel / Motor Starter – The system shall be furnished with a Local Control Panel. The panel shall be housed in a NEMA 4X enclosure. The Local Control Panel shall control the exhaust fan and be mounted 3' away from the system.

1. NEMA 4X SST enclosure with:
    a. 480v main circuit breaker
    b. Control transformer – 120v
    c. Controls/Contacts/Alarms
        i. HOA switch for fan
        ii. Main power disconnect
        iii. Red "On" pilot light
        iv. Motor Starter for Exhaust Fan
        v. Dry Contacts for:
            1. Exhaust Fan Run
            2. Fan Fail

2.10 PREFILTER

A. Prefilter shall be provided to collect airflow, remove moisture / particulate and direct it into the vessel. The prefilter shall be integral to the vessel body.

B. Housing: Housing shall be manufactured using fiberglass reinforced plastic. Stainless or alternate plastic materials are not acceptable. Manufacturer shall have a minimum of 10 year' experience in the design and supply of similar equipment. Manufacturer shall retain the services of an independent inspector who is responsible to confirm the prefilter has been manufactured in accordance with this specification and all FRP work meets or exceeds ASME RTP-1 level 2 visual inspection criteria.

1. Resin system shall be a corrosion resistant vinyl ester with a class 1 flame spread rating. Acceptable products are AOC K022-AC or Dow Derakane 510-B series. Resin system shall not require any additives such as nyacol or antimony to achieve the class 1 flame spread rating. Finished laminate including liner and structure shall be translucent.

2. All internal surfaces shall have a 100-mil corrosion liner made up of a single nexus veil followed by two layers of 1.5 oz. chopped strand mat.
3. All exterior surfaces shall have gelcoat applied. This coating shall contain UV inhibitors, color to be selected by the owner.
4. Housing shall have machined UMHW guides to prevent stainless frame on filter pad from scratching or damaging the corrosion liner.
5. Filter housing shall be designed for 12" positive and negative pressure with a maximum of 1/8" deflection.
6. Housing shall have an access door for pad removal complete with EPDM gasket and 316 Stainless hinges / quick latches. For filter housings larger than 3' across, two access doors shall be provided. Access doors shall have stainless toggle clamps for easy pad access. Bolt-on access doors are not acceptable.
7. Housing shall be provided with a 2" drain connection at the base, and come from the manufacturer complete with ball valve.
8. Housing shall be provided with a 2" drain connection at the base, and come from the manufacturer complete with ball valve.
9. For installation, housing shall have (2) adjustable legs. Length of legs shall be coordinated with the contractor. Housing shall be supported by these legs independent of the connecting ductwork, anchored with stainless steel HILTI bolts.
10. Housing shall have a differential gauge bracket and be supplied with a magnehelic pressure gauge and connections for gauge on either side of filter pad. Unit shall come complete from the factory with all DP equipment pre-assembled and installed.

C. Filter Pad
1. Pad shall have 2" of stainless mesh followed by 4" of poly mesh. Mesh shall be held together by a stainless steel frame. Total pad width including pads and frame shall be 8".
2. Maximum pad segment width of pads is 24". Pads larger than 24" wide must be segmented to allow easy removal by the owner. Segment width should not exceed 24"

D. Dimensions / Design:
1. End connections shall be sized for a maximum air velocity of 2500 f/m. Flange dimensions shall match the connecting ductwork. Flange thickness shall not be less than that listed in ASTM 3982.
2. Suction side of prefilter shall be plain-end to allow for connection to plain-end piping with external flexible pipe coupling.
3. Inlet cone shall be designed so that the airstream can spread evenly over the pad surface. Cone angle shall be no less than 60 deg.
4. Housing shall be sized so that air velocity through the filter pad is 400 f/m.
5. Particle removal efficiency shall be 99% of particles 10 microns or larger.

2.11 ADSORBER VESSEL ACCESSORIES

A. 16 gauge SST name plate with ¼" die-stamped equipment tag number securely mounted in a readily visible location.

B. 316 SST lifting lugs

C. 316 SST anchor bolts sized by the equipment manufacturer (1/2" minimum) and supplied by contractor

PART 3 – EXECUTION

3.01 FACTORY TESTING

A. All equipment shall be factory tested for compliance with the requirements specified herein.

1. Acetone test conducted on interior surfaces of vessels per ASTM C 582, paragraph 9.2.2.
2. Barcol hardness readings of vessel walls per ASTM D 2583, paragraph 12. As a minimum one set of readings for the top, two sets of readings for the vertical straight shell and on set of readings for the bottom.

3.02 FUNCTIONAL TESTING

A. Functional testing shall be conducted after the installation of the carbon vessels and all appurtenances and the equipment has been operated for a sufficient period to make any corrections or adjustments. Each carbon vessel shall be subject to field functional tests under actual operating conditions to determine that operation is satisfactory and in compliance with the Specifications.

B. The Contractor will provide, calibrate, and install all temporary gauges and meters, and install all temporary piping and wiring required for the functional tests.

C. The functional tests shall include the following:

1. Alignment: Test complete assemblies for correct and proper alignment and connection, and quiet operation
2. Flow Throughput: Measured by system or temporary instrumentation.
3. Discharge and Inlet Static Pressure: Measured by system instrumentation or temporary measurement devices.
4. Test all system components for proper adjustment and operation in both manual and automatic operating modes.

D. System Start-up

1. Shall be performed by qualified representative of the manufacturer.

3.03 MANUFACTURER'S SERVICES

A. Manufacturer's Representative: No onsite training or start-up is required.
B. O&M: Manufacturer to provide O&M and Training Video.
C. Warranty
   1. The manufacturer shall warrant that the equipment shall be free from defects in material and workmanship for a period of 18 months from acceptance or 24 months from shipment, whichever occurs first. This warranty excludes the carbon media itself.
   2. In the event that the equipment fails to perform as specified, the Manufacturer will promptly repair or replace the defective equipment without additional cost to the Owner.
   3. Extended Service Agreement shall be included in the Odor Control System installation. Extended Service Agreement shall include at a minimum a biannual inspection of the system to conduct routine maintenance and repairs.

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SECTION 41 43 33.13

GRINDER

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers the furnishing and installation of in-line grinders and controllers. The equipment shall be provided with vertically mounted drive units, control panel, anchor bolts and all other appurtenances specified or otherwise required for proper operation.

B. The number of grinders and controllers shall be one (1).

1.2 REFERENCES

A. Grinders shall, as applicable, meet the requirements of the following industry standards:
   1. American Society for Testing and Materials (ASTM) A36: Carbon Steel Plate
   2. American Society for Testing and Materials (ASTM) A536-84: Ferritic Ductile Iron Castings
   3. American Society for Testing and Materials (ASTM) A48-83: Grey Iron Casting
   4. American National Standards Institute (ANSI) B16.42-1979, Class 150 Flanges
   5. American Iron and Steel Institute (AISI) 303 Stainless Steel
   6. American Iron and Steel Institute (AISI) 304 Stainless Steel
   7. American Iron and Steel Institute (AISI) 316 Stainless Steel
   8. American Iron and Steel Institute (AISI) 4130 Heat Treated Alloy Steel
   9. American Iron and Steel Institute (AISI) 4140 Heat Treated Alloy Steel
   10. American Iron and Steel Institute (AISI) 8620 Heat Treated Alloy Steel
   11. American Iron and Steel Institute (AISI) 17-4 Stainless Steel
   12. Society of Automotive Engineers (SAE) 660 Bearing Bronze

B. Controllers shall, as applicable, meet the requirements of the following Regulatory Agencies:
   1. National Electrical Manufacturer’s Association (NEMA) Standards
   2. National Electric Code (NEC)
   3. Underwriters Laboratory (UL and cUL)

4. International Electrotechnical Commission (IEC)

1.3 DOCUMENTS

A. Submittals

1. Complete assembly, foundation and installation drawings, together with detailed specifications and data covering material used, drive unit, parts, devices and other accessories forming a part of the equipment furnished, shall be submitted in accordance with the Submittals section. The data and specifications for the unit shall include, but shall not be limited to, the following:

a. Grinder

1). Manufacturer

2). Type and Model

3). Rpm at rated condition

4). Size of suction flange

5). Size of discharge flange

6). Net weight of grinder and baseplate

7). Base and anchor bolts and details

8). Type and manufacturer of bearings

b. Motor

1) Manufacturer

2) Type and Model

3) Horsepower rating

4) Temperature rating and service factor

5) Full load rotative speed

6) Full load current

7) Torque per horsepower

c. Gear Reducer

1). Manufacturer

2). Type and model

3). Input horsepower rating

4). Efficiency

5). Gear ratio

6). Net weight

d. Controls

1). Arrangement, outline dimensions

2). Wiring and schematic diagram

B. Operation and Maintenance Manuals.

1. The supplier shall provide three (3) Operation & Maintenance manuals. An electronic version shall be supplied to create additional copies. The manuals shall include approved shop drawings, test reports, equipment descriptions, operating instructions, drawings, troubleshooting techniques, a recommended maintenance schedule, and other recommended maintenance data (i.e., lubricants).

1.4 QUALITY ASSURANCE

A. Identification

1. Equipment shall be identified with a corrosion resistant nameplate affixed in a conspicuous location.

2. Nameplate information shall include manufacturer's name and address, equipment model number, and serial number.

B. Manufacturer

1. Supplier shall provide a list of reference sites for similar equipment for verification by the Engineer or Owner's Representative.

2. Supplier shall conduct factory testing and verification of equipment prior to shipment.

C. Installation & Start-up

1. Supplier shall provide services of a factory trained representative to check installation and review start-up of equipment and controls.

2. Supplier Representative shall inspect and approve site installation and supervise a review of the operation of the equipment.

3. Supplier Representative shall provide training on operation and maintenance requirements of the equipment.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging

1. Containers or skids shall be constructed for normal shipping, handling, and storage.

2. Containers shall provide adequate protection for the equipment in a dry indoor environment between +40º F (+4.5º C) and +100º F (+37.8º C).

1.6 WARRANTY

A. Provide warranty for a period of 12 months after the final acceptance of the equipment by the Owner and Engineer. The warranty shall stipulate that the equipment furnished is suitable for the purpose intended and free from defects of material and workmanship for the duration of the warranty. In the event the equipment fails to perform as specified, the Manufacturer will promptly repair or replace the defective equipment without additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Grinders and controllers shall be in accordance with these specification and plans and shall be as manufactured by JWC Environmental or Franklin-Miller.

2.2 SERVICE CONDITIONS

A. General: Furnish equipment suitable for the process and service conditions described below and in the Schedule of Service Conditions.
   1. All grinders will normally receive municipal gravity sewer flow.

B. Schedule of Service Conditions:
   1. Location: Coleman Lakes Pump Station
      a. Total Number of Units: 1
   2. Grinder shall be capable of processing 620 GPM.
   3. Grinder shall provide peak shaft torque of 4,756 lb-in/hp (721 Nm/kW).
   4. Grinder shall provide peak force at cutter tip of 2,051 lb_f/hp (12,234 N/kW).
   5. Continuous and momentary peak torque per hp (in-lb): 1,200; 3,000
      a. Liquid Processed: Municipal Wastewater
      b. Suction Conditions: Gravity feed.
      c. Motor and motor speed: 5 HP and 1,800 rpm (max)

2.3 GRINDER

A. General
   1. Each unit shall be a two-shaft design with two parallel shafts alternately staked with intermeshing cutters and spacers that counter rotate at different speeds.

B. Components

1. Cutters and Spacers

   a. Cutting stack shall be a nominal height of twelve (12) inches.

   b. Cutter shall be an individual disk constructed of ASTM 4130 alloy steel surface ground to thickness of .310-inches +.000/-.001 (7.9 mm +.000/-.003).

   c. Cutters shall be heat treated to produce a hardness of 45-50 Rockwell C.

   d. Cutters shall have 11 cam shaped teeth. Tooth height shall not be greater than ½-inch (13 mm) above the root diameter of the cutter.

   e. Spacers shall be an individual disk constructed of ASTM 4130 alloy steel surface ground to a thickness of .319-inches +.001/-.000 (8.1 mm +.003/-.000).

   f. Spacers shall have a hardness of 32-38 Rockwell C.

   g. Spacers shall have a smooth outside diameter with no tooth profiles.

2. Shafts

   a. Shafts shall be ASTM 4140 alloy steel with a minimum tensile strength of 149,000 PSI (1,027 kPA).

   b. Shafts shall measure nominal 2-inches (51 mm) across flats of hex.

   c. Shafts shall be hardened to 38-42 Rockwell C.

3. Seal Cartridges

   a. Seal cartridges shall be rated to a maximum of 90 PSI (620 kPA).

   b. Seal cartridges shall not require flushing.

   c. Dynamic and rotating seal faces shall be tungsten carbide with 6% nickel binder.

   d. O-rings shall be Buna-N (Nitrile).

   e. Radial and axial loads shall be borne by sealed, oversized, deep-groove ball bearings.

4. Housings and Covers

   a. Main body, gear, base, and end housings shall be ASTM A536-84 ductile iron.

   b. Top cover and inspection port covers shall be ASTM A536-84 ductile iron.

c. Main body housing shall have inlet and outlet flanges with bolt pattern machined to a four (4) inch pipe flange size.

d. Main body housing shall have integral side wall deflectors to direct solids into cutters.

e. Inspection port covers shall be on both inlet and outlet sides of main body housing.

f. End housing shall have integral bushing deflectors to guide solids away from seal cartridges.

5. Speed Reducer

a. Reducer shall be manufactured by Sumitomo Machinery Corporation of America.

b. Reducer shall be internal planetary mechanism with trochoidal curved tooth profile.

c. Reducer shall be a vertically mounted with 29:1 single reduction.

d. Reducer shall be grease lubricated.

6. Motor

a. Motor shall be manufactured by Baldor Electric Company.

b. Motor shall be 5 hp, 1725 rpm, 230/460 volt, 3 phase, 60 Hz immersible motor rated for both submerged and non-submerged service.

c. Motor shall have a minimum service factor of 1.15, 87.5% minimum efficiency factor at full load, minimum 78% power factor at full load.

7. Lifting Eyes/Lugs

a. All equipment weighing more than 100 pounds shall be provided with lifting eyes or lugs.

8. Anchor bolts

a. Anchor bolts and nuts shall be furnished for each item of equipment. Anchor bolts together with template or setting drawings shall be delivered sufficiently in advance to permit setting the anchor bolts when the structural concrete is placed.

2.4 CONTROLLER

A. General

1. Controller shall provide control of the grinder and be designed to control one (1) 3 hp motor at 460 volts, 3 phase, 60 Hz. Each motor controller shall utilize a solid

state logic design with line transient protection to 1,000 volts. The controller shall have an indicator lights, switches and other control devices.

B. Components

1. Enclosures

   a. Enclosure shall be fiberglass reinforced polyester NEMA 4X .

   b. Enclosure shall house the control devices, motor starters, and PLC.

2. Grinder ON-OFF/RESET-REMOTE three-position 22mm type, NEMA 4X selector switch

   a. In the OFF/RESET position, the grinder shall not run.

   b. In the ON position, the grinder shall run continuously.

   c. In the REMOTE position, the grinder shall start and stop as controlled by an external device.

   d. Selector switch shall be the only method for resetting the controller after failure.

3. Main disconnect: 600 volt, 3 pole 42,000 amperes interrupting at 480 volt circuit breaker with trip indicating and pad lockable off external handle.

4. Pilot Lights

   a. Lights shall be LED type 22 mm, rated NEMA 4X.

   b. Lights shall indicate POWER ON, RUN, and FAIL.

5. Programmable Logic Controller (PLC)

   a. PLC shall be manufactured by Panasonic.

   b. PLC shall have a minimum of 16K of memory.

6. Motor Starter

   a. Starter shall be a full-voltage reversing type with 120 volt operating coils.

   b. Overload relays shall be adjustable and sized to full load amperes (FLA) of the motor.

7. Control Transformer

   a. Control transformer shall be minimum 130 VA.

   b. Control transformer primary and secondary shall be fused for over current protection.

8. Current Transducer

a. Current transducer shall be manufactured by Veris Industries.

b. Current transducer shall have adjustable set point from 1-135A with 200 ms or less response time.

C. Performance

1. When a grinder jam obstruction occurs, the controller shall stop the grinder and reverse the rotation to clear the obstruction. If the obstruction is cleared, the controller shall return the grinder to normal operation. If three (3) reverses occur within a 30 second interval, the controller shall stop the grinder motor in a jam condition and activate the grinder FAIL indicator and relay.

2. Upon a grinder jam or overload condition, the grinder controller shall provide a dry contact rated at 5 amps at 120 volts for remote use by the sludge pump controller. The contact shall be closed at all times unless the grinder has entered into a jam or overload condition. If a jam or overload condition occurs, then the contact shall open and stay open until the "Hand Off/Reset Auto selector switch is switched to the Off/Reset position. The contact shall be used to de-energize the sludge pump.

3. The grinder controller shall also provide three normally open dry contacts rated 5 amps at 120 volts for remote use. One contact shall close when the grinder is running; the second contact shall close when a jam or overload condition has occurred, and the third contact shall close when the "Hand-Off/Reset-Auto" selector switch is the Auto position. The jam or overload condition contact shall reopen when the Hand-Off/Reset-Auto selector switch is set to the Off/Reset position.

4. When a power failure occurs while the grinder is operating, the grinder will resume operation once power is restored.

5. When a power failure occurs while the grinder is in a fail condition, once power is restored the fail indicator shall reactivate and remain until reset.

6. Reset of the grinder shall be accomplished from the controller only.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Grinder(s) and controller(s) shall be installed in accordance with supplier's installation instructions, and in accordance with all OSHA, local, state, and federal codes and regulations.

B. The grinder base shall be grouted after initial fitting and alignment but before final bolting of connection piping. After final alignment and bolting, grinder conections shall be tested for applied piping stresses by loosening flange bolts. If any movement or

opening of the joints is observed, piping shall be adjusted to ensure that piping stresses are not transmitted to the grinder flanges.

3.2 PAINTING

A. The grinder unit shall be factory prepared, primed and finish coated with the manufacturer's standard protective coating system.

3.3 TESTING

A. Test of grinder(s) shall demonstrate correct alignment, smooth operation. Test period shall demonstrate simulated jam conditions for grinder.

3.4 SPARE PARTS

A. Furnish and deliver the following boxed and labeled:
   1. One set of unidirectional cutters, spacers and a complete gasket set kit
   2. All special tools required for maintenance of the equipment shall be provided with the spare parts.

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DIVISION 44

PUMPS

SECTION 44 42 41
DRY-PIT FLOODED SUCTION PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This section covers the Work necessary for pump refurbishment and part replacement, as indicated on the drawings, for the existing dry pit flooded-suction pumps.

1.2 GENERAL

A. Like items of equipment provided hereunder shall be the end products of one Manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and Manufacturer's service.

B. See CONDITIONS OF THE CONTRACT, and Division 01, GENERAL REQUIREMENTS, which contain information and requirements that apply to the work specified herein and are mandatory for this project.

C. Unit Responsibility: The Work requires the Dry-Pit Flooded Suction Pumps complete with all accessories and appurtenances (including, but not necessarily limited to, Pump, Motor, Local Control Panels, spare parts, start-up, testing, and personnel training) be the end product of one responsible Manufacturer. Unless otherwise indicated, the Contractor shall obtain each system from the Manufacturer of the equipment, which Manufacturer shall provide all components of the system to enhance compatibility, ease of construction, and efficient operation and maintenance, and as necessary to place the equipment in operation and its intended functions without altering or modifying the Contractor's responsibilities under the Contract Documents. The Contractor is responsible to the Owner for performance of all equipment systems as indicated.

D. The equipment specified herein is included as a sole source item, and a proposal letter is included with the Bid Form. Refer to the Bid Form and the Instructions to Bidders for additional requirements.

1.3 SUBMITTALS

A. Submittals shall be made as required in Section 01 33 00, SUBMITTAL PROCEDURES of Division 01, GENERAL REQUIREMENTS. The following specific information shall be provided:
   1. Shop Drawings: Shop drawings shall include descriptive information as required to fully describe the Pumps, Controls, Motors, and overall performance and shall identify any deviations from the specified requirements.
   2. Special handling instructions, in accordance with Section 01 60 00, PRODUCT REQUIREMENTS.

3. Requirements for storage and protection prior to installation, in accordance with Section 01 60 00, PRODUCT REQUIREMENTS.
4. Requirements for routine maintenance required prior to plant startup, in accordance with Section 01 60 00, PRODUT REQUIREMENTS.
5. List of all requested exceptions to the Contract Documents.
6. Motor information to be submitted in accordance with Division 26, ELECTRICAL.
7. Quality control submittals as listed in Section 01 33 00, SUBMITTAL PROCEDURES of Division 01, GENERAL REQUIREMENTS.
8. Instrumentation and control submittals as listed in Section 26 09 00, [INSTRUMENTATION AND CONTROLS.
9. Factory Test Reports (Balance & Vibration).

1.4 OPERATION AND MAINTENANCE DATA

A. O&M Manuals: Content, format, and schedule for providing as specified in Section 01 78 23, OPERATION AND MAINTENANCE DATA.

B. Maintenance Summary Forms: As specified in Section 01 78 23, OPERATION AND MAINTENANCE DATA.

1.5 WARRANTY

A. Provide warranty for a period of 12 months after the final acceptance of the equipment by the Owner and Engineer. The warranty shall stipulate that the equipment furnished is suitable for the purpose intended and free from defects of material and workmanship for the duration of the warranty. In the event the equipment fails to perform as specified, the Manufacturer will promptly repair or replace the defective equipment without additional cost to the Owner.

B. Spare parts identified within this specification shall not be used to address warranty repairs.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Contractor shall refurbish both pumps and replace equipment including, but not limited to:

1. Impellers, seals, gaskets, and bearings.

2.2 MANUFACTURERS

A. Fairbanks-Nijihuis.

2.3 PUMP ACCESSORIES

A. Equipment Identification Plate: A 16-gauge stainless steel identification plate shall be securely mounted on each pump in a readily visible location. The plate shall bear the 1/4" die-stamped equipment identification number name that is assigned to each pump in the Submersible Pump Data Sheets and shown on the Drawings.

B. Lifting Lugs: Equipment weighing over 100 pounds shall be provided with lifting lugs.

C. Painting: Provide touch-up painting for post-installation.

D. See Dry-Pit Submersible Pump Data Sheets following this Section.

E. Spare Parts and Special Tools: See Dry-Pit Submersible Pump Data Sheets for spare parts and special tools required for each pump or set of pumps.

2.4 ELECTRICAL AND CONTROL SYSTEMS

A. Electrical products and execution required to complete the Work under this section shall conform to the applicable requirements of Division 26, ELECTRICAL.

B. Labeling: All electrical materials, devices, appliances, and equipment used shall be indicated as acceptable by established standards. Indication shall be by a valid label affixed to the item. Panels that consist of multiple components shall be listed and labeled as a unit in addition to any other requirements.

PART 3 - EXECUTION

3.1 SHIPPING, STORAGE, HANDLING, AND PROTECTION

A. As specified in Section 01 60 00, PRODUCT REQUIREMENTS.

3.2 INSTALLATION

A. Work shall be as specified in Section 01 60 00, PRODUCT REQUIREMENTS.

3.3 PAINTING AND COATING

A. Shop prime and field finish paint ferrous metal in accordance with and as specified in Section 09 90 00 PAINTING AND PROTECTIVE COATINGS Division 09, FINISHES, System No. 2 for all submerged metal surfaces and System No.4 for all non submerged metal surfaces.

B. Exposed metal surfaces of motors, gear reducers, and drive assemblies shall be factory prepared and primed and field finish coated in accordance with Section 09 90 00 PAINTING AND PROTECTIVE COATINGS Division 09, FINISHES, System No. 4.

3.4 FACTORY TESTS

A. Motor Tests and Test Reports: As specified in Division 26, ELECTRICAL.

B. Balance of Vibration: The rotating parts of each pump and its driving unit shall be dynamically balanced before final assembly. The driving unit alone shall operate without vibration in excess of the limits stated in the latest revision of NEMA MG 1.

3.5 FIELD TESTS

A. Functional Test: Prior to plant startup, all equipment described herein and in the Submersible Pump Data Sheets following shall be inspected for proper alignment, quiet operation, proper connection, and satisfactory performance by means of a functional test. Provide certification of test results. Tests and certification shall be as specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA.

B. Vibration Test: The complete assembly, consisting of the driving unit and pump, connected and in normal operation, shall not develop amplitudes of vibration exceeding limits recommended by the current edition of Hydraulic Institute Standards. If directed by Engineer, vibration tests shall be conducted at Contractor's sole expense to determine amplitude of vibration, and Contractor shall make any corrections necessary to meet these requirements. If corrections are made, a second vibration test shall be done following corrections.

3.6 MANUFACTURER'S SERVICES

A. Provide representative for three (3) days on-site to verify correct installation, equipment testing, equipment certification, and personnel training.

3.7 MANUFACTURER'S CERTIFICATE(S)

A. Provide Manufacturer's certificate(s). In accordance with Section 01 79 00, DEMONSTRATION AND TRAINING.

END OF SECTION

SECTION 44 42 50
SUBMERSIBLE PUMPS

PART 1 GENERAL

1.01 SUMMARY

A. This Specification details the requirements for submersible pumps for wastewater pump stations.

B. This is not intended to be an all-inclusive specification for the construction of a submersible type station. Site and conditions may make it necessary to modify the requirements of this section.

C. All pump stations shall include a minimum of two pumps (duplex arrangement) sized to convey the PHF with one pump out of service.

D. All pump stations shall include a Mission unit for remote monitoring in accordance with Section 40 90 01, Instrumentation and Control for Process Systems.

E. Pump station shall be provided with a standby engine pump or generator. Standby engine driven pump or generator shall be natural gas fueled unless service is not available.

F. This specification is supplemented by the data and drawings provided of the installation site, conditions and performance requirements. Review drawings for:

1. Capacity (GPM).
   a. Pump 1 – 900 GPM
   b. Pump 2 – 500 GPM
2. Total Dynamic Head (FT).
   a. Pump 1 – 92.5 FT
   b. Pump 2 – 82 FT
3. Total Discharge Static Head (FT).
   a. Pump 1 – 76 FT
   b. Pump 2 – 76 FT

1.02 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. American Bearing Manufacturers Association (ABMA):
   a. 9, Load Ratings and Fatigue Life for Ball Bearings.
   b. 11, Load Rating and Fatigue Life for Roller Bearings.

2. American Society of Mechanical Engineers (ASME): B16.1, Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125, and 150.
3. ASTM International (ASTM):
   a. A48, Standard Specification for Gray Iron Castings.
   b. A576, Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
4. Hydraulic Institute Standards (HIS):
   a. 11.6, Submersible Pump Test.
   b. 14.6, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests.
5. National Electrical Manufacturers Association (NEMA).
6. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code.
   b. 497, Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.
7. Underwriters Laboratories Inc. (UL).

1.03 DEFINITIONS

A. Terminology pertaining to pumping unit performance and construction shall conform to ratings and nomenclature of Hydraulic Institute Standards.

1.04 EXTRA MATERIALS

A. Furnish for this set of pumps:

1. One set mechanical seals.
2. One complete set of special tools required to dismantle pump.
3. Impeller.

PART 2 PRODUCTS

2.01 GENERAL

A. Submersible, vertical shaft, centrifugal nonclog type, for pumping wastewater.

B. Designed for continuous operation under submerged or partially submerged conditions, and intermittent operation when totally dry without damage to pump or motor.

C. Pump and Electrical Driver: Meet requirements for class, group, and division location in accordance with NFPA 70.

D. Where adjustable frequency drives are required or specified, furnish a coordinated operating system complete with pump, drive, and speed controller.

E. Pumps and associated components to include the control panel to be provided by a single manufacturer.

2.02 MANUFACTURERS

A. Acceptable manufacturers are:

1. ABS.
2. Flygt.
3. No equal or alternate will be accepted.

2.03 COMPONENTS

A. Equipment consists of pump complete with motor, control system, guide rail, anchoring brackets, base elbow, power cable, and pump lifting cable, access hatch(s) and control panel and level switches.

B. Characteristics:

1. Motor and rotating parts shall be removable from motor end of pump.
2. Mating surfaces to be watertight and fitted with nitrile O-rings.
3. Pumps fitted with dynamically balanced nonclog impellers designed to pass course solids and stringy materials.

C. Lifting Arrangement:

1. Type 316 stainless steel chain, 2 feet minimum, and one “grip-eye.”
2. Attach chain permanently to pump and access platform with stainless steel wire rope.
3. “Grip-eye” capable of being threaded over and engaging links of stainless steel chain so pump and motor may be lifted with “grip-eye” and independent hoist.

D. Sliding Guide Bracket:

1. Integral part of pump unit.
2. Pump unit to be guided by no less than two guide bars of Type 316 stainless steel construction, and pressed tightly against discharge connection elbow with metal-to-metal contact or through use of profile-type gasket, provided gasket is attached to pump’s flange and can be easily accessed for inspection when pump is lifted out of wetwell.
3. Pump metal parts that come into contact with guide rail or cable system shall be made of nonsparking materials.

E. Motor nameplate horsepower not to be exceeded at head-capacity point on pump curve.

F. Pump motor and sensor cables shall be suitable for submersible pump application and cable sizing shall conform to NFPA 70 specifications for pump motors. Cables shall be of sufficient length to reach junction boxes without strain or splicing.

G. Motor Protection Module: If required, provide pump with a motor protection module for remote mounting. Contract Drawings are based on first named submersible pump manufacturer and motor protection module. If pump and motor protection module other than first named manufacturer is provided, provide revised wiring for the motor protection module.

H. Cable Entry System:

1. Junction chamber and motor separated by stator lead sealing gland or terminal board that prevents foreign material entering through pump top.
2. Utilize cable with factory-installed sealing gland with nonshrink epoxy seal system.
3. O-ring compression seal between sealing gland and cable entry point shall also be acceptable.

2.04 CONTROL PANEL

A. Type 304 stainless steel, NEMA 4X enclosure, for outdoor duty.

B. Refer to Section 40 90 01, Instrumentation and Control for Process Systems, for panel requirements.

C. Free standing, post mounted.

D. The pump supplier shall furnish and install a complete pump control panel to control, operate, and display information as indicated in the plans and specifications. The control system shall include all equipment, devices, wiring, and incidental materials to operate the system and display or relay information in accordance with these specifications. The intention of this section is to secure a complete control system that will operate equipment in accordance with narratives and requirements indicated in the plans, specifications, and manufacturer's literature for the equipment installed.

E. Features:

1. Main circuit breaker disconnect interlocked with panel door.
2. Reduced voltage soft starter motor controllers. Soft starters shall be specifically design for fluid pumping applications and be rated for the ambient conditions.

3. Fused control power transformer, 120V ac.
4. Alternator and pump lead-lag controls.
5. ON/OFF/AUTO switches.
6. Running lights.
7. High level indication.
8. Normally closed, dry, 5 amps at 120V ac contacts for remote indication of:
    a. High level alarm.
    b. Pump failure (temperature or moisture alarm).
9. Terminal strip for interfacing with external wiring.
10. High temperature indication.
11. Moisture alarm indication.
12. Alarm (high temperature, moisture, or high level) beacon located on top of panel.
13. Lightning protection.
14. Intrinsically safe relays as required for UL validation.
15. Alarm silence button.
16. Phase failure relay.
17. Document pocket located inside panel with pump and panel operation and maintenance manual, and separate laminated pump curve.
18. 110-volt, duplex GFI outlet, weather-protected, and accessible from outside of panel.
19. Run hour meter.
20. 100 watts minimum, condensation heater with thermostat.
21. UL listing mark.

F. Prewired and factory tested.

G. Air conditioned where required for proper operation of controls, reduced volage soft starters, or adjustable/variable frequency drives.

H. Mount control switches, indicating lights, and switches on hinged front panel.

I. Single Feed: 480 volts, three-phase.

J. Pump station control panel shall include a Mission unit for remote monitoring in accordance with Section 40 90 01, Instrumentation and Control for Process Systems.

2.05 ACCESSORIES

A. Level Switches: In accordance with Section 40 90 01, Instrumentation and Control for Process Systems, Component L8 and for:

1. Low Low Level: Pumps off.
2. High High Level: Alarm.

B. Level Transmitter: In accordance with Section 40 90 01, Instrumentation and Control for Process Systems, Component L52.

C. Variable/Adjustable frequency drive where specified and required by the ESD.

D. Equipment Identification Plate: 16-gauge Type 316 stainless steel with 1/4-inch die-stamped equipment tag number securely mounted in readily visible location.

E. Anchor Bolts: Type 316 stainless steel, sized by equipment manufacturer.

F. Sidewalk Door: Sized by equipment manufacturer with the following additional requirements:

1. Gasketed and odor tight.
2. Channel drain is not required.
3. Aluminum.

2.06 PIPING

A. Piping shall be ductile iron in accordance with Section 40 27 00, Force Main Piping-General. Transition to high density polyethylene pipe is permitted at property line of the pump station or as approved by the ESD after the valve vault and self-regulated automatic valve(s).

B. Heat trace and insulate all exposed piping in accordance with Sections 40 42 13, Process Piping Insulation and 40 05 33, Pipe Heat Tracing.

2.07 FACTORY FINISHING AND TESTING

A. Manufacturer’s standard finish for outside installation in a corrosive environment.

B. Functional Test: Perform manufacturer’s standard test on equipment.

C. Performance Test:

1. In accordance with Hydraulic Institute Standards.
2. Adjust, realign, or modify units and retest accordance with Hydraulic Institute Standards if necessary.

D. Hydrostatic Tests: Pump casing(s) tested at 150 percent of shutoff head. Test pressure maintained for not less than 5 minutes.

2.08 SOURCE QUALITY CONTROL

A. Control Panel:

1. Factory Inspections: Inspect control panels for required construction, electrical connection, and intended function.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's printed instructions.

B. Mount the discharge elbow to the floor of the wetwell floor with stainless steel bolts.

C. Connect piping without imposing strain to flanges.

D. No portion of pump shall bear directly on floor of sump.

3.02 FIELD QUALITY CONTROL

A. Functional Test: With the ESD Electrician and the Engineer present conduct on each pump.

1. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
2. Flow Output: Measured by calibrated temporary flow measurement device.
3. Operating Temperatures: Monitor bearing areas on pump and motor for abnormally high temperatures.
4. Test for continuous 3-hour period.

3.03 OPERATIONS MANUAL

A. Prior to start-up of station and training, provide the ESD three hard copies and one digital copy of an operating and maintenance manual for the overall pump station and all installed components.

3.04 MANUFACTURER'S SERVICES

A. Manufacturer's Representative: Present at Site or classroom designated by ESD for minimum person-days listed below, travel time excluded:

1. 1 person-day for installation assistance and inspection.
2. 0.5 person-day for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
3. 0.5 person-day for post-startup training of the ESD staff.

B. Manufacture shall provide a certificate or proper installation for the pumps and control panel.

END OF SECTION

SECTION 44 42 65

FACTORY-BUILT BASE MOUNTED PUMP STATION

WITH DUPLEX/SIMPLEX SELF-PRIMING PUMPS, STANDBY ENGINE, AND

PLC-BASED CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Contractor shall furnish and install one factory built, automatic pump station. The station shall be complete with all equipment specified herein, factory assembled on a common steel baseplate. Equipment shall include but not be limited to:

1. Two self-priming, horizontal, centrifugal, v-belt motor driven sewage pumps.
2. One water cooled standby engine.
3. Valves, and piping.
4. A PLC based pump motor control panel with thermal-magnetic circuit breakers, magnetic motor starters, automatic liquid level control systems for normal and standby operation, and internal wiring.

B. This Specification is supplemented by the data and Drawings provided of the installation site, conditions and performance requirements. Review Drawings for:

1. Capacity (GPM).
2. Total Dynamic Head (FT).
3. Total Dynamic Suction Lift (FT).
4. Maximum Repriming Lift (FT).
5. Maximum Static Suction Lift (FT).
6. Total Discharge Static Head (FT).
7. Minimum Submergence Depth (FT).
8. Fault current provided at the pump station control panel.

1.02 REFERENCES

A. Publications listed below form part of this specification to extent referenced in the text by basic designation only. Consult latest edition of publication unless otherwise noted.

1. American National Std. Institute (ANSI) / American Water Works Assoc. (AWWA):
    a. ANSI B16.1 Cast iron pipe flanges and flanged fittings.
    b. ANSI/AWWA C115/A21.51 Cast/ductile iron pipe with threaded flanges.
    c. ANSI 253.1 Safety Color Code for Marking Physical Hazards.
    d. ANSI B40.1 Gages, Pressure and Vacuum.
    e. AWWA C508 Single Swing Check Valves.
2. American Society for Testing and Materials (ASTM):
    a. ASTM A48 Gray Iron Castings.
    b. ASTM A126 Valves, Flanges, and Pipe Fittings.
    c. ASTM A307 Carbon Steel Bolts and Studs.
    d. ASTM A36 Structural Steel.
3. Institute of Electrical and Electronics Engineers (IEEE):
    a. ANSI/IEEE Std 100 Standard Dictionary of Electrical Terms.
    b. ANSI/IEEE Std 112 Test Procedure for Polyphase Induction Motors.
    c. IEEE Std 242 Protection of Industrial and Control Power Systems.
4. National Electric Code (NEC) / National Electrical Manufacturers Assoc. (NEMA):
    a. NEC National Electric Code.
    b. NEC 701 National Electric Code article 701.
    c. NEMA Std MG1 Motors and Generators.
5. Miscellaneous References:
    a. Ten-State Standards Recommended Standards for Sewage Works.
    b. Hydraulic Institute Std for Centrifugal, Rotary and Reciprocating Pumps.
    c. NMTBA and JIC Std. National Machine Tool Builders Association and Joint Industrial Council Standards
    d. ISO 9001 International Organization for Standardization.

1.03 DEFINITIONS

A. The term “pump manufacturer” or “pump station manufacturer” shall be defined as the entity which designs, machines, assembles, hydraulically tests and warranties the final product.

1.04 SUBMITTALS

A. Product Data:

1. If requested by the ESD, prior to fabrication, pump station manufacturer shall submit five copies of submittal data for review and approval. Submittal shall include:

a. Electrical ladder logic drawings. The electrical ladder logic drawings shall illustrate motor branch and liquid level control circuits to extent necessary to validate function and integration of circuits to form a complete working system.

b. Catalog cuts sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor and v-belt drive data, pump characteristic curves showing the design duty point capacity (GPM), head (FT), net positive suction head required (NPSHr), and hydraulic brake horsepower (BHP). Electrical components used in the motor branch and liquid level control shall be fully described.

c. Shop Drawings detailing layout of mechanical equipment and anchor bolt locations for equipment baseplate.

d. Installation manual. Comprehensive instructions shall enable personnel to properly install, operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience on exact equipment supplied.

e. Operations, control and maintenance manual.

f. Documentation shall be specific to the pump station supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the station manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall be included in the manual to detail the overall pumping system/station. Operations, control and maintenance manual shall include the following as a minimum:

1) Functional description of each major component, complete with operating instructions.

2) Instructions for operating pumps, engine and pump controls in all modes of operation.

3) Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.

4) Support data for all components not produced by the station manufacturer, but supplied in accordance with the Specifications. Data shall be supported by literature from the prime manufacturer and incorporated as appendices.

5) Electrical schematic diagram of the pump station circuits shall be in accordance with NFPA70. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the station operator, need not be included. Details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.

6) Mechanical layout drawing of the pump station and components, prepared in AutoCAD that detail all dimensions and location of all pumps, motors, engine, valves, piping and appurtenances.

7) Operation and maintenance instructions which rely on vendor cut-sheets and literature and that include general configurations, or require operating personnel to selectively read portions of the manual shall not be acceptable.

1.05 QUALITY ASSURANCE

A. The pumps and pump station manufacturer must be ISO 9001 certified, with scope of registration including design control and service after sales activities.

B. Upon request from the ESD and the Engineer, the pump station manufacturer shall prove financial stability and ability to produce the station within the specified delivery schedules. Evidence of facilities, equipment and expertise shall demonstrate the manufacturer's commitment to long term customer service and product support.

C. Manufacturer must show proof of original product design and testing. Products violating intellectual property regulations shall not be allowed, as they may violate international law and expose the ESD or Engineer to unintended liabilities. “Reverse-

engineered" products fabricated to substantially duplicate the design of original product shall not be allowed, as they may contain substantial differences in tolerances and material applications addressed in the original design, which may contribute to product failure.

1.06 PERFORMANCE CRITERIA

A. Pumps must be designed to handle raw, unscreened, domestic sanitary sewage. All internal passages, impeller vanes, and recirculation ports shall pass a 2.5-inch spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with priming and pump performance shall not be permitted. Upon request from the ESD or Engineer, manufacturer's certified drawings showing size and location of the recirculation port(s) shall be submitted for approval.

B. Each pump shall be selected to perform to the operating conditions detailed on the Drawings.

C. Reprime Performance:

1. Consideration shall be given to the sanitary sewage service anticipated, in which debris is expected to lodge between the suction check valve and its seat, resulting in the loss of the pump suction leg, and siphoning of liquid from the pump casing to the approximate center line of the impeller. Such occurrence shall be considered normal, and the pump must be capable of automatic, unattended operation with an air release line installed.

2. During unattended operation, the pump shall retain adequate liquid in the casing to insure automatic repriming while operating at its rated speed in a completely open system. The need for a suction check valve or external priming device shall not be required.

3. Pump must reprime the height/vertical feet detailed on the Drawings at the specified speed and impeller diameter. Reprime lift is defined as the static height of the pump suction above the liquid, while operating with only one-half of the liquid remaining in the pump casing. The pump must reprime and deliver full capacity within five minutes after the pump is energized in the reprime condition.

4. Reprime performance must be confirmed and upon request from the ESD or Engineer, certified performance test results, prepared by the manufacturer, and certified by a registered professional engineer, shall be submitted for approval prior to shipment. Test setup and operating requirements include:

a. A check valve to be installed downstream from the pump discharge flange. The check valve size shall be equal (or greater than) the pump discharge diameter.

b. A length of air release pipe shall be installed between pump and the discharge check valve. This line shall be open to atmosphere at all times duplicating the air displacement rate anticipated at a typical pump station fitted with an air release valve.

c. The pump suction check valve shall be removed. No restrictions in the pump or suction piping will prevent the siphon drop of the suction leg. Suction pipe configuration for reprime test shall incorporate a 2 feet minimum horizontal run, a 90 degree elbow and vertical run at the specified lift. Pipe size shall be equal to the pump suction diameter.

d. Impeller clearances shall be set as recommended in the pump service manual.

e. Repeatability of performance shall be demonstrated by testing five consecutive reprime cycles. Full pump capacity (flow) shall be achieved within five minutes during each cycle.

f. Liquid to be used for reprime test shall be water.

1.07 EXTRA MATERIALS

A. One spare pump mechanical seal (complete), and with it all gaskets, seals, sleeves, O-rings, and packing required to be replaced during replacement of the seal.

B. One set of impeller clearance adjustment shims.

C. One set cover plate O-ring.

D. One rotating assembly O-ring.

1.08 SPECIAL MANUFACTURER'S WARRANTY

A. The pump station manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship.

B. A written warranty shall include specific details described below.

1. In addition to defects in material and workmanship, fiberglass reinforced polyester station enclosures (where applicable) are warranted for 60 months to be resistant to rust, corrosion, corrosive soils, effects of airborne contamination or physical failures occurring in normal service for the period of the pump station warranty.

2. All other equipment, apparatus, and parts furnished shall be warranted for 60 months, except those items that are normally consumed in service, such as light bulbs, oils, grease, packing, gaskets, O-rings, etc.

C. The pump station manufacturer shall be solely responsible for warranty of the station and all components.

D. Components failing to perform or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer.

PART 2 PRODUCT

2.01 MANUFACTURER'S UNITARY RESPONSIBILITY

A. In order to unify responsibility for proper operation of the complete pumping station, it is the intent of these Specifications that all system components be furnished by a single supplier (unitary source). The pumping station must be of standard catalog design, totally warranted by the manufacturer.

B. A system consisting of parts compiled and assembled by a manufacturer's representative or distributor shall not be accepted.

2.02 MANUFACTURERS AND PRODUCTS

A. Acceptable manufacturers are: Gorman Rupp, Super T, Ultra V Series or Ultramate.

2.03 PUMP COMPONENTS AND MATERIALS OF CONTRUCTION

A. Pump:

1. Pump casing: Casing shall be cast iron Class 30 with integral volute scroll and include the following features:

a. Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.

b. Fill port coverplate, 3 1/2-inch diameter, shall be opened after loosening a hand nut/clamp bar assembly.

c. Hand nut threads to allow slow release of pressure.

d. The clamp bar shall be retained by detent lugs.

e. A Teflon gasket shall prevent adhesion of the fill port cover to the casing.

f. Casing drain plug shall be at least 1 1/4-inch NPT to insure complete and rapid draining.

2. Coverplate: Coverplate shall be cast iron Class 30 and shall include the following features:

a. Retained by hand nuts for complete access to pump interior.

b. Provide ample clearance for removal of stoppages, and allow service to the impeller, seal, wearplate or check valve without removing suction or discharge piping.

c. A replaceable wearplate secured to the coverplate by weld studs and nuts shall be AISI 1015 HRS.

d. A pressure relief valve in the coverplate. Relief valve shall open at 75-200 psi.

e. Two O-rings of Buna-N material shall seal coverplate to pump casing.

f. Pusher bolt capability to assist in removal of coverplate. Pusher bolt threaded holes shall be sized to accept same retaining capscrews as used in rotating assembly.

g. Easy-grip handle mounted to face of coverplate.

3. Rotating Assembly: A rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, sealplate and bearing housing, shall be removable as a single unit without disturbing the pump casing or piping Rotating assembly shall include the following features:

a. Sealplate and bearing housing shall be cast iron Class 30. Separate oil filled cavities, vented to atmosphere, shall be provided for shaft seal and bearings. Cavities must be cooled by the liquid pumped. Lip shall prevent leakage of oil. Additional features and requirements include:

1) The bearing cavity shall have an oil level sight gauge and fill plug check valve. A clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil without removal of the fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.

2) The seal cavity shall have an oil level sight gauge and fill/vent plug. A clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the fill/vent plug.

3) Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.

b. Impeller shall be ductile iron, two-vane, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lock screw and conical washer.

c. Shaft shall be AISI 17-4 pH stainless steel.

d. Bearings shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation.

1) Bearings shall be oil lubricated from a dedicated reservoir.

2) Pump designs which use the same oil to lubricate the bearings and shaft seal shall not be acceptable.

e. Shaft seal shall be oil lubricated mechanical type. The stationary and rotating seal faces shall be tungsten titanium carbide alloy.

1) Each mating surface shall be lapped to within three light bands flatness (35 millionths of an inch), as measured by an optical flat under monochromatic light.

2) The stationary seal seat shall be double floating by virtue of a dual O-ring design; an external O-ring secures the stationary seat to the sealplate, and an internal O-ring holds the faces in alignment during periods of mechanical or hydraulic shock (loads which cause shaft deflection, vibration, and axial/radial movement).

3) Elastomers shall be viton.

4) Cage and spring to be stainless steel.

5) Seal shall be oil lubricated from a dedicated reservoir.

6) The same oil shall not lubricate both shaft seal and shaft bearings.

f. Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same capscrews as used for coverplate.

4. Adjustment of the impeller face clearance (distance between impeller and wearplate) shall be accomplished by external means.

a. Clearances shall be maintained by a four point external shimless coverplate adjustment system, utilizing a four collar and four adjusting screw design allowing for incremental adjustment of clearances by hand as required. Each of the four points shall be lockable to prevent inadvertent clearance increases or decreases due to equipment vibration or accidental operator contact. The four point system also allows for equal clearance gaps at all points between the impeller and wear plate. Requirement of realignment of belts, couplings, etc., shall not be acceptable. Coverplate shall be capable of being removed without disturbing clearance settings. Clearance adjustment systems that utilize less than four points will not be considered.

b. Provisions shall be provided for additional clearance adjustment in the event that adjustment tolerances have been depleted from the coverplate

side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above.

c. Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

5. An externally removable suction check valve shall be molded Neoprene with integral steel and nylon reinforcement. A blow-out center shall protect pump casing from hydraulic shock or excessive pressure. Removal or installation of the check valve must be accomplished from the top of pump without disturbing the suction piping or completely draining the casing. Sole function of check valve shall be to save energy by eliminating need to reprime after each pumping cycle. Pumps requiring a suction check valve to assist reprime will not be acceptable.

B. Unit Base:

1. The unit base shall be comprised of structural steel with a perimeter flange and reinforcements.

2. Perimeter flange and reinforcements shall be designed to prevent flexing or warping under operating conditions.

3. Perimeter flange shall be drilled for hardware used to secure unit base to concrete pad as shown on the Contract Drawings.

4. Unit base shall contain provisions for lifting the complete pump unit during shipping and installation.

C. Pump Drain Kit:

1. The pump drain kit shall consist of a 10-foot length of plastic hose with a quick connect female Kamlock fitting on one end of hose and two sets of fittings for pump drains. Each set of fittings for pump drain includes a stainless steel pipe nipple, stainless steel bushing, stainless steel ball valve and an aluminum quick connect male Kamlock fitting.

D. Volute Casing Heaters:

1. Where installed in an unheated area/enclosure or where required by the ESD or Engineer, pump shall be provided with a thermostat mounted to the exterior of the volute casing, and 115 volt electric heater inserted into the interior of the volute by means of a dedicated port. The heater shall be energized at 40 degrees F and sized to prevent freezing to 0 degrees F to provide heat to the casing and eliminate the possibility of freezing.

2. Heater probes that must be installed through a pump drain port is not be acceptable.

3. Heater probes that must be installed through a pump drain port is not be acceptable.

E. Isolation, Check and Self-Regulated Automatic Valves:

1. All pumps shall be include discharge isolation valve, check valve and self-regulated automatic valve (also referenced as air release/air vacuum valves).

F. Piping: All piping shall be ductile iron in accordance with Sections 40 27 00, Force Main Piping and 40 27 01, Ductile Iron Pipe and Fittings.

G. Pipe and Valve Support: Valves and pipes shall be supported in accordance with Section 40 27 10, Piping Specialties.

H. Dismantling: To allow removal of pumps and valves provide dismantling fittings on suction and discharge side of pumps in accordance with Section 40 27 10, Piping Specialties.

I. Heat Trace and Insulation: Heat trace and insulate all exposed piping in accordance with Sections 40 42 13, Process Piping Insulation and 40 05 33, Pipe Heat Tracing.

J. Gauge Kit:

1. Each pump shall be equipped with a glycerin-filled compound gauge to monitor suction pressures, and a glycerin-filled pressure gauge to monitor discharge pressures. Gauges shall be a minimum of 4 inches in diameter, and shall be graduated in feet water column. Rated accuracy shall be 1 percent of full scale reading. Compound gauges shall be graduated minus 34 feet to plus 34 feet water column minimum. Pressure gauges shall be graduated 0 to 140 feet water column minimum.

2. Gauges shall be mounted on a resilient panel and frame assembly which shall be firmly secured to pumps or piping. Gauge installations shall be complete with all hoses and stainless steel fittings, and shall include a shutoff valve installed in each gauge inlet at the point of connection to suction and discharge pipes.

2.04 ELECTRIC MOTOR

A. Pump motors shall be horizontal ODP, 1800 RPM, NEMA design B with cast iron frame with copper windings, induction type, with class F insulation and 1.15 SF for normal starting torque and low starting current characteristics, suitable for continuous service. The motors shall not overload at the design condition or at any head in the operating range as specified.

B. Motors shall be tested in accordance with provisions of ANSI/IEEE Std 112.

C. Motor with engine shall be of a double shaft configuration.

2.05 STANDBY (LPG/NATURAL GAS) ENGINE

A. Standby engine shall be a four cylinder or six cylinder, EPA Certified Duel Fuel (LPG/natural gas), water cooled type, and shall have continuous duty power rating suitable for the horsepower requirements of the pump. Engine shall be supplied with connections for both LPG and natural gas fuels. Engine shall be cooled by an integral water cooling system capable of maintaining safe engine operating temperature under expected operating loads, and subject to the expected maximum ambient temperatures in the pump station enclosure.

B. The engine shall be equipped with all controls and components required for manual and automatic operation when used with the engine controls and DC level control system described in these specifications. Such components shall include, but not be limited to, the following:

1. 12 Volt dc electrical system including starter and alternator.
2. Storage battery, 84 ampere-hour capacity minimum.
3. Elapsed running time meter.
4. Sensors for engine temperature, oil pressure, and overspeed.
5. Critical grade exhaust silencer to limit engine exhaust noise.
6. Switch for manual operation of the cranking motor, mounted on or near the engine.
7. Voltmeter.
8. Solenoid fuel lock-off valve suitable for use with natural gas or LPG service.
9. Lube oil pressure gauge.
10. Jacket water temperature gauge.
11. Tachometer.
12. J1939 trouble codes.

C. Engine electrical equipment shall be wired to a terminal board on the engine and pre-wired to the base secured control panel.

D. The following minimum performance standards shall be used for engine selection:

1. Engine speed shall be controlled by an electronic, governor-controlled throttle which shall maintain the preset speed over the range of expected pumping loads. This speed shall not be less than 1,800 rpm to insure adequate cooling, nor more than 3,000 rpm so that internal engine wear is held to a minimum. This governed speed shall not be acceptable if it is greater than that speed at which the engine torque and horsepower curves intersect. Engine manufacturer's published performance curves shall be submitted for review to support engine selection.

2. The engine shall develop approximately 95 percent of manufacturer's published performance after a reasonable run-in period.

3. For selection of engine size, engine performance shall be derated according to manufacturer's specifications to allow for decreased performance if installed at elevations more than 1,000 feet above sea level.

4. For selection of engine size, engine performance shall be derated according to manufacturer's specifications to allow for decreased performance in an ambient temperature of 100 degrees F, which can reasonably be expected in the pump station.

5. Engine rating shall be further reduced to conform to engine manufacturer's recommendations for continuous service applications.

E. Brake horsepower requirements of pump shall not exceed calculated engine horsepower after derating for power available after run-in, temperature compensation, and altitude compensation.

2.06 DRIVE TRANSMISSION

A. Power shall be transmitted from engine to pump by a V-belt drive assembly through a centrifugal clutch mounted on a jackshaft, which shall be coupled or otherwise interfaced with a shaft extension on the pump motor. Jackshaft shall be constructed of steel, not less than 1-1/2 inches in diameter, and shall be mounted in two pillow blocks furnished with anti-friction roller bearings.

1. Each drive assembly shall have a minimum of two V-belts or one synchronized belt system. Each V-belt drive assembly shall be selected on the basis that adequate power will be transmitted from driver to pump based on the data developed in accordance with drive calculations.

2. Precise alignment tolerances of the drive assemblies shall be achieved by means of a belt/sheave laser alignment system resulting in the reduction of vibration, accelerated wear, and premature failure.

3. Centrifugal clutch shall be designed to remain disengaged until engine has reached some speed greater than idle speed to reduce starting loads. Once engaged, clutch shall be rated to transmit power continuously until engine speed has been reduced below disengagement speed. Clutch shall disengage completely while engine is not operating.

4. Belt guards:

    a. Pump drive transmissions shall be enclosed on all sides in a guard constructed of any one or combination of materials consisting of expanded, perforated, or solid sheet metal, except that maximum perforated or expanded openings shall not exceed 1/2 inch.

    b. Guards shall be manufactured to permit complete removal from the pump unit without interference with any unit component, and shall be securely fastened to the unit base.

    c. All metal shall be free of burrs and sharp edges. Structural joints shall be continuously welded. Panels may be riveted to frames with not more than 5-inch spacing. Tack welds shall not exceed four-inch spacing.

d. The guard shall be coated in accordance with section 3, Color Definitions of ANSI 253.1; Safety Color Code for Marking Physical Hazards.

2.07 FINISH

A. Pumps, piping, motors and exposed steel framework shall be coated with a high build epoxy system rated for use in a highly corrosive environment as recommended by Tnemic, Sherwin Williams, Porter or an equal manufacturer. Coating system(s) shall be applied to a prepared surface in accordance with the manufacturer's recommendations. Prepared and coated in accordance with the painting manufacturer's directions with a high build epoxy. The finish shall allow for over-coating and touch up after final installation.

2.08 ELECTRICAL CONTROL COMPONENTS

A. The pump station control panel will be tested as an integral unit by the pump station manufacturer. The control panel shall also be tested with the pump station as a complete working system at the pump station manufacturer's facility.

B. The electrical control components shall be provided by the pump station supplier and conform to the requirements of Section 26 05 01, Electrical, Section 40 90 01, Instrumentation and Control for Process Systems along with the following additional requirements.

C. Panel enclosure:

1. Enclosure shall be constructed in conformance with applicable section of National Electrical Manufacturers Association (NEMA) standards for type 1 electrical enclosures. Enclosure shall be fabricated of Type 304 stainless steel of not less than 12 gauge.

2. Enclosure shall be equipped with a door mounted on a continuous steel hinge, and sealed around its perimeter. Door shall be held closed with clamps that are quick and easy to operate. The door shall accommodate the mounting of switches and indicators.

3. Enclosure shall be furnished with a removable back panel, fabricated of Type 304 steel having a thickness of not less than 0.106 inch (12-gauge), which shall be secured to the enclosure with collar studs. Such panel shall be of adequate size to accommodate all basic components.

4. All control components shall be securely fastened to a removable back panel with screws and lock washers. Switches, indicators and instruments shall be mounted through the control panel door. All control devices and instruments shall be secured to the sub-plate with machine screws and lockwashers. Mounting holes shall be drilled and tapped; Self-tapping screws shall not be used to mount any components. All connections from the back panel to door mounted or remote devices shall be made through terminal blocks. All control devices shall be clearly labeled to indicate function.

D. Motor Branch Components:

1. Main Connections:

a. A main terminal block and ground lug shall be furnished for field connection of the electrical supply. The connections shall be designed to accept copper conductors of sufficient size to serve the pump station loads. The main terminal block shall be mounted to allow incoming wire bending space in accordance with Article 373 of the National Electric Code (NEC). A separate terminal strip shall be provided for 115 volt, single phase control power and shall be segregated from the main terminal block. Ten percent of the control terminals shall be furnished as spares.

b. All motor branch and power circuit components shall be of highest industrial quality. The short circuit current rating of all power circuit devices shall be a tested combination or evaluated per the National Electrical Code Article 409. The lowest rated power circuit component shall be the overall control panel short circuit rating and shall not be less than the fault current available. The minimum control panel rating shall not be less than 10 kA, rms symmetrical. Control assemblies operating at 120 volts nominal or less may be provided with transformers which limit the fault current and may be rated less than the minimum required short circuit rating.

2. Circuit breakers and operating mechanisms:

a. A properly sized heavy duty air circuit breaker shall be furnished for each pump motor. All circuit breakers shall be sealed by the manufacturer after calibration to prevent tampering.

b. A padlocking operating mechanism shall be installed on each motor circuit breaker. Operator handles for the mechanisms shall be located on the exterior of the control compartment door, with interlocks which permit the door to be opened only when circuit breakers are in the "off" position. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.

3. Auxiliary Power Transformer:

    a. The lift station shall be equipped with a 5 KVA step-down transformer to supply 115 volt, AC, single phase for the control and auxiliary equipment.

    b. The primary and secondary side of the transformer to be protected by a thermal magnetic circuit breaker, sized to meet the power requirements of the transformer.

    c. An operating mechanism shall penetrate the control panel door and a padlockable operator handle shall be secured on the exterior surface.

    d. Interlocks must prevent opening the door until circuit breakers are in "OFF" position.

    e. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.

4. Motor Starter:

    a. A reduced voltage, solid state motor starter shall be furnished for each pump motor. The starter construction shall be modular with separately replaceable power and control sections. The power section shall consist of six back-to-back SCR's rated 208 to 480 volts, 50/60 hertz. The SCR's shall have a minimum repetitive peak inverse voltage rating of 1,400 volts at 480 volts. The enclosed operating temperature range shall be 0 to 40 degrees C at altitudes up to 2000 meters without derating.

    b. Starting Modes: Starting modes shall be selectable soft start, current limit, or full voltage. Soft starting the pump shall include an adjustable initial torque value of 0 to 90 percent. The acceleration ramp shall be adjustable from 0 to 30 seconds. The starter shall include a selectable kick start providing a current pulse at start. Kick start level shall be adjustable from 0 to 90 percent of locked rotor torque. Kick start time shall be adjustable from 0 to 2 seconds. Current limit mode shall provide means for limiting the starting current to a programmable value between 50 and 600 percent of full load current. Full voltage start shall provide across the line starting with a ramp time of less than 0.25 seconds.

c. Pump Control Mode: Ramp time will be dependent on pump torque requirements. The starter shall provide smooth acceleration and deceleration, which approximates the flow rate of a centrifugal pump. The starter's microcomputer shall analyze motor variables and generate control commands, which will minimize surges in the system. Pump stop time shall be adjustable from 0 to 120 seconds. Pump control provides reduced hydraulic shock.

d. Bypass: When the start ramp time is complete, the starter shall energize an integral bypass contactor. When in the bypass mode, the bypass contactor shall carry the motor load to minimize internal heating in the electrical enclosure.

e. Protection: The starter shall include protective features: Communication fault, control temperature, excess starts/hour, stall, jam, line fault, open gate, overload, overvoltage, phase reversal, power loss, underload, undervoltage, shorted SCR, open bypass and voltage unbalance.

1) An integral electronic overload relay equipped with thermal memory shall be included and shall utilize three phase current sensing. Adjustments shall include trip current, service factor and 10, 15, 20 or 30 trip class.

2) Jam trip shall be adjustable 0-1,000 percent of the nominal motor current with a delay time adjustment of 0-99 seconds.

3) Stall protection senses that the motor is not up-to-speed at end of ramp and will shut down after a user-selected delay time has elapsed. Stall delay shall be adjustable from 0-10 seconds.

4) Fault diagnostics shall be displayed on the starter and shall include temperature fault, line fault, open gate and power loss.

f. Door Mounted Display: Each starter shall be furnished with a display and keypad mounted to the door of the control panel. The door mounted display will duplicate the functions of the starter display and allow the operator to monitor or change parameters without opening the control panel door.

E. Transient Voltage Surge Suppressor: The control panel shall be equipped with a transient voltage surge suppressor to minimize damage to the pump motors and control from transient voltage surges. The suppressor shall utilize thermally protected silicon-oxide varistors encapsulated in a non-conductive housing. Mechanical indicators shall be provided on each phase to indicate protection has been lost. The suppressor shall have a surge current rating of 100,000 amps per phase and a 100kA interrupting rating.

F. Voltage Alert Indication: The control panel shall include a voltage alert indicator to reduce the risk of electrical arc flash by pre-verifying the electrical isolation from outside of the control panel. Hardwired to the main incoming point of termination, the indicator shall be powered by the same voltage that it indicates utilizing redundant circuitry, thereby flashing whenever voltage is present. An eight detector display shall visually alert the presence of dangerous ac or dc potentials occurring between any combination of the monitored input lines.

G. Three Phase Voltage Monitor: The control panel shall be equipped to monitor the incoming power and shut down the pump motors when required to protect the motor(s) from damage caused by phase reversal, phase loss, high voltage, low voltage, and voltage unbalance. An adjustable time delay shall be provided to minimize nuisance trips. The motor(s) shall automatically restart, following an adjustable time delay, when power conditions return to normal.

H. Other Control Components:

1. The control circuit shall be fused, and shall be provided with a disconnect switch connected in such a manner as to allow control power to be disconnected from all control circuits.

2. Pump mode selector switches shall be connected to permit manual start and manual stop of each pump motor individually. Manual operation shall override shutdown systems supplied with the level control system except motor overload.

3. Pump alternation shall be integral to the PLC (Programmable Logic Controller). Provisions for automatic alternation or manual selection shall also be integral to the PLC (Programmable Logic Controller).

4. A selector switch shall provide manual alternation of the air pumps in the bubbler system. The switch shall be connected in such a manner that either pump may be selected to operate continuously.

5. A pushbutton shall be provided on the operator interface to silence the alarm circuits while corrective actions are underway. Depressing the alarm reset pushbutton shall also cause any alarm circuit to reset when the condition has been corrected.

6. High pump temperature shutdown circuit:

a. The control panel shall be equipped with circuitry to override the level control system and shut down the pump motor(s) when required to protect the pump from damage caused by excessive temperature.

b. A thermostat shall be mounted on each pump to detect its temperature. If the pump temperature should rise to a level which could cause pump damage, the thermostat shall cause the shutdown circuit to drop out the motor starter. An indicator, visible on the operator interface shall indicate that the pump motor has been stopped because of a high temperature condition. The pump shall remain locked out until the pump has cooled and the circuit has been manually reset. Automatic reset of such a circuit shall not be acceptable.

7. Six digit elapsed time meters (non-reset type) shall be connected to each pump motor starter to indicate the total running time of each pump in "hours" and "tenths of hours".

8. A duplex ground fault indicating utility receptacle providing 115V ac, 60 hertz, single phase current shall be mounted on the side of the control enclosure. Receptacle circuit shall be protected by a 15 ampere thermal-magnetic circuit breaker.

9. Indicating lights shall be oil tight type and equipped with integral step-down transformers for long lamp life. Lamps shall be incandescent type rated 14 volts or less. Lamps shall be replaceable from the front without opening the control panel door and without the use of tools. Indicating lights will be provided for the following functions:

   a. Alarm condition.

   b. Pump #1 run.

   c. Pump #2 run.

   d. 115 volt power available.

I. Wiring:

1. The pump station components, as furnished by the manufacturer, shall be completely pre-wired.

2. All wiring, workmanship, and schematic wiring diagrams shall be in compliance with applicable standards and specifications for industrial controls set forth by the Joint Industrial Council (JIC), National Machine Tool Builders Association (NMTBA), and the National Electric Code (NEC).

3. All user serviceable wiring shall be type MTW or THW, 600 volts, and shall be color coded as follows:

   a. Line and load circuits, AC or DC power: Black.

   b. AC control circuit less than line voltage: Red.

   c. DC control circuit: Blue.

d. Interlock control circuit, from external source: Yellow.

e. Equipment grounding conductor: Green.

f. Current carrying ground: White.

g. Hot with circuit breaker open: Orange.

4. Wire identification and sizing:

a. Control circuit wiring inside the panel, with the exception of internal wiring of individual components, shall be 16-gauge minimum, type MTW or THW, 600 volts. Wiring in conduit shall be 14-gauge minimum. Motor branch wiring shall be 10-gauge minimum.

b. Motor branch conductors and other power conductors shall not be loaded above the temperature rating of the connected termination. Wires shall be clearly numbered at each end in conformance with applicable standards. All wire connectors in the control panel shall be of the ring tongue type with nylon insulated shanks. All wires on the sub-plate shall be bundled and tied. All wires extending from components mounted on door shall be terminated on a terminal block mounted on the back panel. All wiring outside the panel shall be installed in conduit.

5. Control conductors connecting components mounted on the enclosure door shall be bundled and tied in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall be allowed so that the door can swing to its full open position without undue mechanical stress or abrasion on the conductors or insulation. Bundles shall be clamped and held in place with mechanical fastening devices on each side of the hinge.

J. Conduit requirements are as follows:

1. All conduit and fittings shall be UL listed and in accordance with Section 26 05 01, Electrical.

2. Conduit shall be supported in accordance with articles 346, 347, and 350 of the National Electric Code.

3. Conduit shall be sized according to the National Electric Code.

K. Grounding:

1. The pump station manufacturer shall ground all electrical equipment to the enclosure back panel. The mounting surface of all ground connections shall have any paint removed before making final connections.

2. The contractor shall provide an earth driven ground connection to the control panel at the main ground lug in accordance with the National Electric Code (NEC).

3. Equipment Marking:

a. Permanent corrosion resistant name plate(s) shall be attached to the control and include following information:

1) Equipment serial number.

2) Control panel short circuit rating.

3) Supply voltage, phase and frequency.

4) Current rating of the minimum main conductor.

5) Electrical wiring diagram number.

6) Motor horsepower and full load current.

7) Motor overload heater element.

8) Motor circuit breaker trip current rating.

9) Name and location of equipment manufacturer.

b. Control components shall be permanently marked using the same identification keys shown on the electrical diagram. Labels shall be mounted adjacent to device being identified.

c. Switches, indicators, and instruments mounted through the control panel door shall be labeled to indicate function, position, etc. Labels shall be mounted adjacent to, or above the device.

2.09 LIQUID LEVEL CONTROL SYSTEM

A. Pump station shall operate on utility power while such power is available, except for exercise periods as specified herein. When operating on utility power, operation of pumps and motors shall be controlled by the level control system as specified herein. During a failure of utility power and during exercise periods, operation of the pump with the standby engine shall be controlled by the level control system and engine control system specified herein. Transfer from normal (utility power) control and to engine control shall occur as follows.

1. PLC based controls shall be provided to accomplish the following functions:

a. All operator adjustable settings shall be accessible via the operator interface without opening control panel door.

b. Time delay after failure of utility power before transfer from normal control to engine control. Delay shall be manually adjustable from 0 to 600 seconds.

c. Time delay after restoration of utility power before transfer from engine control to normal control. Delay shall be manually adjustable from 2 to 1800 seconds.

d. Automatic override of time delay after power restoration, upon occurrence of: engine or engine control failure as specified under engine control system.

e. Manual override of time delay on restoration of normal power. Momentary pushbutton or similar device shall be acceptable.

f. Time delay after transfer from engine control to normal control before application of AC power to motor of pump with standby engine. Such relay shall be preset at approximately 5 seconds to permit engine to stop completely before motor is started.

g. Indicate the presence of utility (normal) power. Such indicator shall be the press-to-test type to permit the operator to verify failure of utility power.

2. These functions and interlocks shall be applicable only to the motor of the pump furnished with the standby engine. No hindrance shall be included for the motor starter and motor branch circuit for the pump which does not have the standby engine. Immediately upon restoration of utility power after power interruption, and during exercise periods, the pump which does not have the standby engine shall be permitted to run if operation of that pump is required by the level control system.

B. Controls shall be provided to cause regular use of the engine control system and standby engine. Such exercise of standby components shall occur to maintain these components in a ready condition, and to discover malfunctions before emergency conditions arise.

1. Exercise periods shall be established by an operator adjustable exercise timer. Timer shall provide a 7-day timing cycle, and shall permit the selection of one to four exercise periods of 0-1440 minute duration, which shall repeat every 7 days.

2. During exercise periods, timer shall simulate a loss of utility power to transfer circuits described herein. After transfer from normal control to engine control, the engine control system shall operate the pump with the standby engine through the engine control system as described in these Specifications.

3. If the standby engine is operating at the end of the exercise period, it shall continue to operate until one of the following conditions occurs:

    a. The standby control system stops the engine through the engine control system, or,

    b. The delay on restoration of utility power relay times out.

4. Upon occurrence of either of these conditions, operation of the engine shall cease and revert to control by the normal control system.

5. During exercise periods, utility power shall remain available to the motor of the pump which does not have the standby engine.

C. Liquid Level Control:

1. The integral PLC level control system shall start and stop the pump motors/engine in response to changes in wet well level, as set forth herein.

2. The integral level control system shall start and stop the standby engine through the engine control system and in response to changes in the wet well liquid level during a failure of utility power and during exercise periods.

3. The level control system shall be capable of operating as either an air bubbler type level control system, submersible transducer type system, or ultrasonic transmitter type system.

4. The level control system shall be designed to accomplish the following tasks:

    a. Continuously monitor the level of liquid in the wet well.

    b. Start and stop pump motors/engine as required by the level of liquid in the wet well.

    c. Select the sequence of pump operation upon operator command for automatic alternation.

    d. Provide alarm indications upon occurrence of predetermined malfunctions.

    e. Upon restoration of utility power after a power outage, the system shall delay the application of power to the engine driven pump, by a length of time that has been preselected by the operator.

5. The level control system shall utilize alternation to select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle, or in the event of excessive run time.

6. EPS Analog Output circuit will be furnished with transient voltage surge suppression to protect related equipment from induced voltage spike from lighting.

D. Submersible Transducer System:

1. In accordance with Section 40 90 01, Instrumentation and Control for Process Systems.

2. An intrinsically safe repeater shall be supplied in the control enclosure. Repeater must be recognized and listed as intrinsically safe by a nationally recognized testing laboratory. Station manufacturer shall make all connections from repeater to feeder lines and motor controls. Installing contractor shall make connections from repeater to transducer.

3. Submersible transducer will be furnished with transient voltage surge suppression to protect related equipment from an induced voltage spike from lighting.

E. Engine Control System (PLC Based):

1. The engine control system shall be designed to accomplish the following tasks:

a. Permit the operator to select mode of engine operation, providing manual start and stop of the engine to override the level control system and cranking circuit if required.

b. Crank the engine upon start command from the level control system, and stop the engine upon a stop command.

c. Stop the cranking sequence if the engine fails to start after a reasonable number of attempts, and provide an alarm indication of failure to start.

d. While the engine is operating, continuously monitor engine speed, temperature and oil pressure.

e. Stop the engine for excessive speed, excessive engine water temperature, or insufficient oil pressure, and provide an alarm indication of shutdown and its cause.

f. Maintain the charge on the engine storage battery.

g. Shutdown features shall be wired to the terminal strip to provide a general alarm indication.

2. Upon operator selection of automatic operation, when the standby level control system provides a start command, the engine control system shall start the engine cranking motor for a short period of time. If the engine does not start, the system shall stop the cranking motor for a short period of time, then resume cranking. Typically, 5 10-second cranking periods, each followed by a 10-second rest period, should be considered a reasonable effort to start the engine. When the engine starts, a sensor on the engine or elsewhere in the

system shall stop the cranking cycle and reset the cranking circuit for the next start.

3. If the engine does not start within the preset number of attempts, the cranking circuit shall be de-energized, a failure to start indicator on the O/I (operator interface) shall be illuminated, and an external alarm device shall be energized. Control of the pump with the standby engine shall be returned to utility power.

4. Once the engine has started normally, the engine control system shall monitor engine speed, cylinder head temperature, and oil pressure. Upon engine failure from any cause, system shall provide an alarm indication, illuminate an indicator on the O/I, and energize and external alarm device as specified below.

5. During periods when the DC control system is fully operative, a battery charger shall continuously charge the engine storage battery.

6. Mode of engine operation:

    a. Switches or other devices shall be provided and connected to perform as follows:

        1) When automatic operation is selected, engine shall start and stop under control of the engine control system.

        2) When manual operation is selected, engine cranking motor shall be controlled by a manual pushbutton or other device on the engine. Once started, engine shall run until off is selected.

        3) Operator can stop engine if it is running, and prevent it from starting during maintenance or repair.

    b. Engine failure circuits shall stop the engine, illuminate an indicator on the O/I, and energize an external alarm device for each of the following conditions:

        1) Engine speed exceeds maximum overspeed setting.

        2) Engine temperature exceeds safe operating temperature as specified by the engine manufacturer.

        3) Engine oil pressure falls below engine manufacturer's specified recommendations. System must override or bypass this function during cranking and several seconds after starting to permit engine to build up oil pressure.

7. Engine control system shall be furnished with one battery charger, designed and connected to operate on 115 volts, ac 60 hertz to maintain the charge on the 12 volt dc storage battery supplied with the engine. Battery charger shall incorporate the following design features:

a. Automatic charge sensing and charging rate adjustment circuit.

b. Integral current limit circuit to limit charging rate.

c. Charging rate ammeter.

d. Fuse for protection of charging circuit.

8. Operating power for the engine control system, except the battery charger, shall be provided by the storage battery furnished with the standby engine during periods of utility power outage.

2.10 PLC CONTROL SYSTEM

A. Programmable Logic Controller:

1. The PLC shall be an Allen-Bradley Micrologix 1500 system. The PLC shall be equipped with a Model LRP CPU with 14K memory, and a configurable port which is reserved for future customer use.

2. The PLC shall operate on 24V dc power and be equipped with the communication devices, digital and analog I/O necessary to accomplish the specified operation. A minimum of 10 percent spare of the I/O used shall be supplied.

3. The program logic shall be stored in battery backed random access memory, as well as on a programmable, read only memory module. The memory module shall auto load and run when installed in the programmable control processor and is included to facilitate field repair or replacement of the programmable control hardware without the use of programming terminals or personal computers.

4. The power supply to the programmable control shall be industrial grade design with integral power factor correction, dc “OK” signal indicator, and adjustable voltage. Operating range shall be minus 10 degrees C to plus 60 degrees C. Power supply shall have infinite short circuit, overvoltage and overtemperature protection. Each motor starter or contactor shall be equipped with a surge suppressor.

5. An Allen-Bradley Panelview 600 color electronic operator interface shall be provided for data entry and display. The operator interface shall be mounted on the front of the control panel with other operator controls. The operator interface shall be a TFT touch-screen terminal. A memory module shall be included.

6. Electromechanical relays and timers, when used shall be equipped with 120V ac coils and contacts rated NEMA A-300 minimum.

7. All user adjustable timer settings shall be PLC based. Time delay adjustment to be accessible via the operator interface without opening control panel door.

B. Control Logic:

1. Control logic shall be accomplished using programmable controllers. Electromechanical relays may be used when necessary. However, the primary control logic shall be performed by the PLC.

2. The O&M manual shall be provided with complete ladder logic program documentation including English names, rung comments, and coil/contact cross-references.

3. The control shall be pre-programmed or wired to provide the following routines:

a. Pump alternation at lead stop.

b. Excessive pump run time alternation.

c. Jump to next pump on lead failure.

d. Start/stop pumps at normal level settings.

e. Pump start delays when called simultaneously.

f. General alarm pilot light activation: Quick flashing alarm/slow flashing acknowledge/ steady on reset/off when clear.

g. Station trouble alarm (115V ac and normally open dry contact).

h. High and low level alarms.

i. Pump start/stop level control.

j. Engine start/stop level control.

k. Pump high temperature shutdown.

l. Transfer to engine control.

m. Phase failure relay.

n. Automatic engine exerciser.

4. The operator interface shall be equipped with the following displays and functions:

a. Main Menu.

b. Wet Well Level.

c. Wet Well Level Simulation.

d. Low Water Alarm Status.

e. High Water Alarm Status.

f. Pump High Temperature Status #1, #2.

g. Engine alarm(s) status (overspeed, high temp, low oil pressure, overcrank, low battery).

h. Pump Sequence Selection.

i. Alarm Silence.

j. Alarm Reset.

k. Alarm History.

l. General Alarm Lamp Test.

m. Lead Level Start/Stop Setpoints.

n. Lag Level Start/Stop Setpoints.

o. Low Water Alarm Setpoints.

p. High Water Alarm Setpoints.

q. Engine Battery Monitor.

r. Idle Function selection for Exercise and/or Power Fail.

s.Power-up Delay Setpoint.

t. Alarm Delay Setpoint.

u. Pump Start Delay Setpoint.

v. Alternation Time Interval Setpoint.

w. Level Transmitter Calibration.

x. Exercise Period Setpoints (4).

2.11 REMOTE MONITORING

A. Pump station shall include a Mission unit for remote monitoring in accordance with Section 40 90 01, Instrumentation and Control for Process Systems.

PART 3 EXECUTION

3.01 EXAMINATION

A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage.

B. Handle in accordance with the manufacturer written instructions.

3.02 INSTALLATION

A. Install, level, align, and lubricate pump station as indicated on project drawings. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.

B. Suction pipe connections are vacuum tight. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on pump station piping. Install and secure all service lines (level control, air release valve or pump drain lines) as required in wet well.

C. Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to station control panel.

D. Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.

3.03 FACTORY TESTING

A. Certified Pump Performance Test:

1. Tests shall be conducted in accordance with Hydraulic Institute Standards 14.6.3.4 Acceptance Grade 2B at the specified head, capacity, rated speed and horsepower. The performance tests will validate the correct performance of the equipment at the design head, capacity and speed.

2. For pumps utilizing up to (13 hp) motors; but larger than (1.3 hp), tests shall be conducted in accordance with Hydraulic Institute Standards 14.6.3.4.1, as the specified head, capacity, rated speed and horsepower.

B. Factory System Test:

1. All components including the pumps, motors, engine, valves, piping and controls will be tested as a complete working system at the manufacturer's facility. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head, capacity, rated speed and horsepower. Factory operational test shall duplicate actual performance anticipated for the complete station.

2. Upon request from the ESD or Engineer, the operational test may be witnessed by the ESD or Engineer, and/or representatives of his choice, at the manufacturer's facility.

3.04 FIELD QUALITY CONTROL

A. Functional Test: With the ESD Electrician and the Engineer present conduct on each pump.

1. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.

2. Flow Output: Measured by calibrated temporary flow measurement device.

3. Operating Temperatures: Monitor bearing areas on pump and motor for abnormally high temperatures.

4. Test for continuous 3-hour period.

3.05 OPERATIONS MANUAL

A. Prior to start-up of station and training, provide the ESD three hard copies and one digital copy of an operating and maintenance manual for the overall pump station and all installed components.

3.06 MANUFACTURER'S SERVICES

A. Manufacturer's Representative: Present at Site or classroom designated by ESD for minimum person-days listed below, travel time excluded:

1. 1 person-day for installation assistance and inspection.

2. 0.5 person-day for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.

3. 0.5 person-day for post-startup training of the ESD staff.

B. Manufacture shall provide a certificate or proper installation for the pumps and control panel.

3.07 CLEANING

A. Prior to acceptance, inspect interior and exterior of pump station for dirt, splashed material or damaged paint. Clean or repair accordingly. Remove from the jobsite all tools, surplus materials, scrap and debris.

3.08 PROTECTION

A. The pump station should be placed into service immediately. If operation is delayed. Station is to be stored and maintained per manufacturer's written instructions.

END OF SECTION

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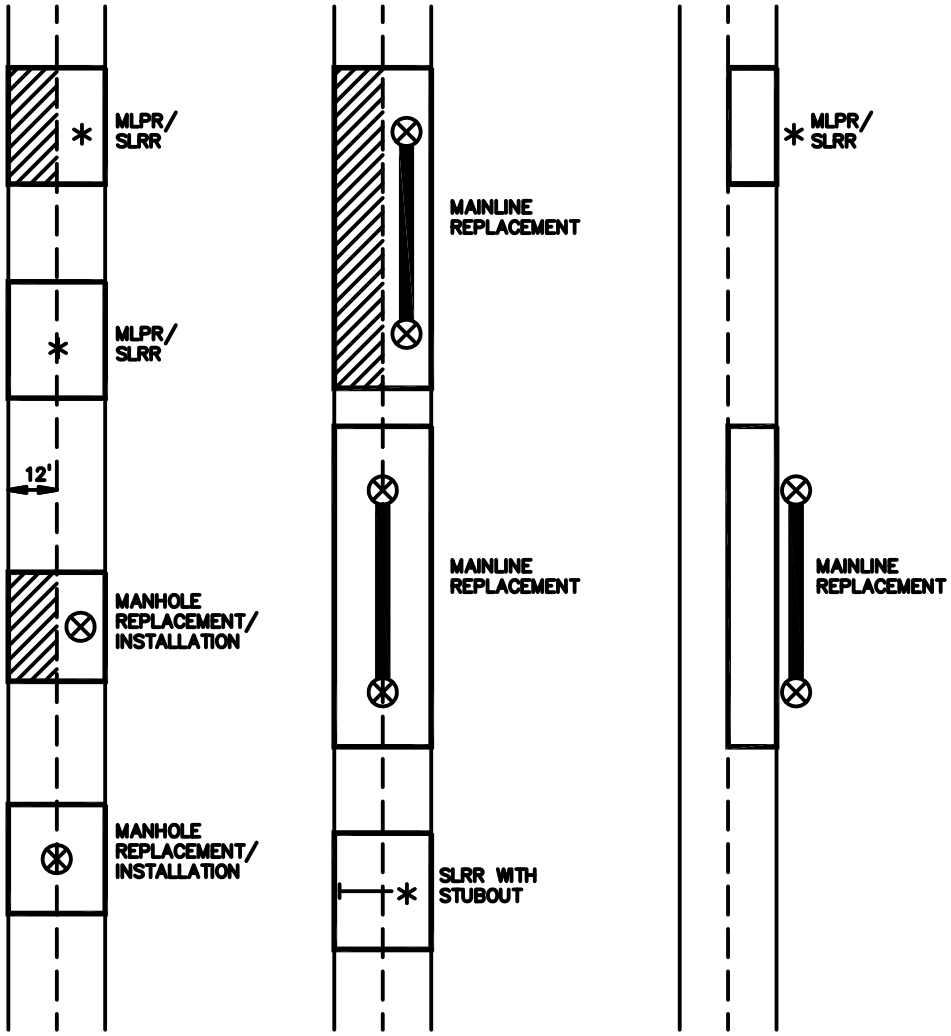
APPENDIX A

STANDARD DRAWINGS



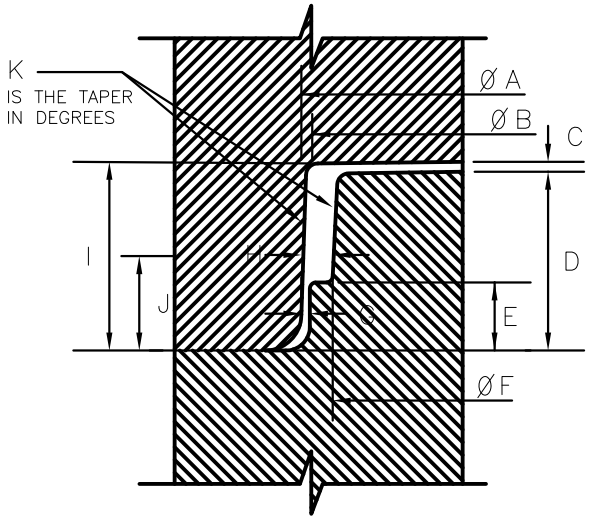
NOT TO SCALE

NOTES:

1. The intent of this drawing is to show "suggested" paving limits only. Paving requirements will vary from site to site depending on location of the sewer line, depth of cut and other field conditions.
2. This drawing assumes 12' lanes.
3. Pavement replacement ends a minimum of 6' past the ditch cut.
4. Milling limits to be determined by the Engineer.

AS DIRECTED
BY THE ENGINEER

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
		PAY LIMIT GUIDELINE FOR PAVEMENT REPLACEMENT
SEPTEMBER 2003		
APPROVED:_____		STANDARD DRAWING NO. SD1100



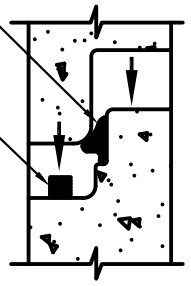
Dia.	ØA	ØB	C	D	E	ØF	G	H	I	J	K
48	53.121	52.966	0.125	4.125	1.600	52.217	0.146	0.452	4.250	2.033	2°
60	67.512	67.315	0.160	5.24	2.68	66.450	0.150	0.500	5.394	3.268	1.8°
72	79.362	79.105	0.160	5.24	2.68	78.233	0.150	0.500	5.400	3.400	1.8°

PRECAST MANHOLE JOINT

N.T.S.

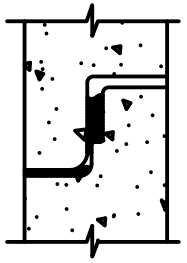
TYLOX–SUPER SEAL PRELUBRICATED GASKET TO BE PLACED FIRMLY AGAINST THE OFFSET ALL THE WAY AROUND THE SPIGOT OF THE MANHOLE.

SEE REQUIRED SIZE CHART FOR CONSEAL CS–231



OPEN MANHOLE JOINT

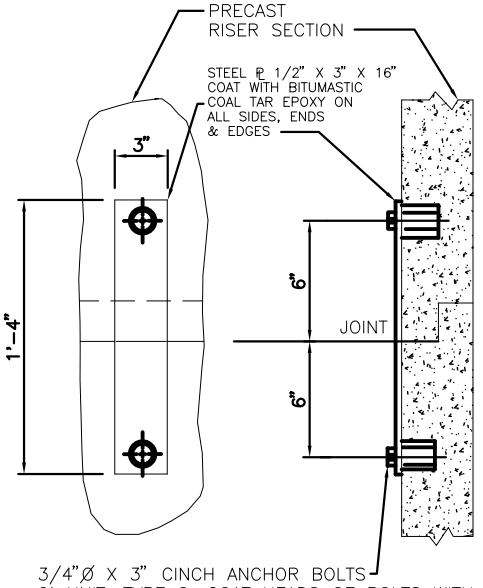
CONSEAL CS–231 REQ'D SIZE CHART	
48" O.D.	3/8
60" I.D.	3/8
72" I.D.	3/8
84" I.D.	3/4
96" I.D.	3/4



SEALED MANHOLE JOINT

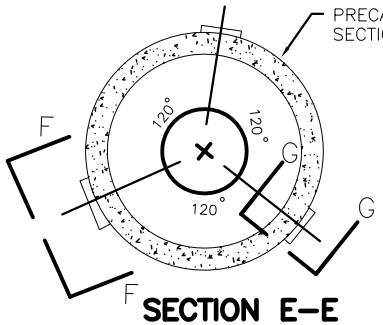
GASKET DETAILS

N.T.S.



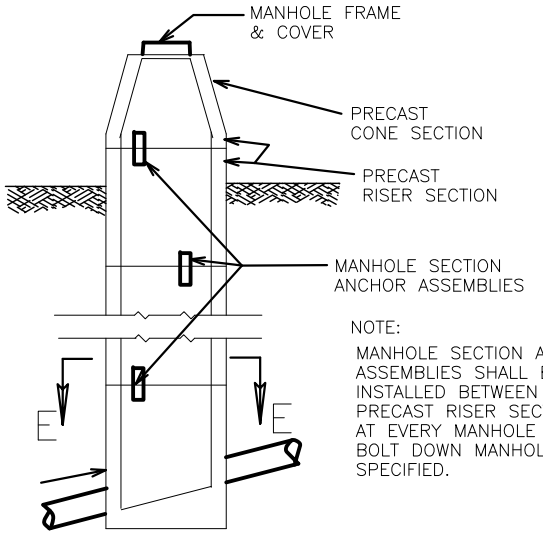
SECTION F–F **SECTION G–G**

3 ANCHOR ASSEMBLIES REQUIRED PER JOINT 120° APART.



SECTION E–E

TYPICAL MANHOLE SECTION ANCHOR

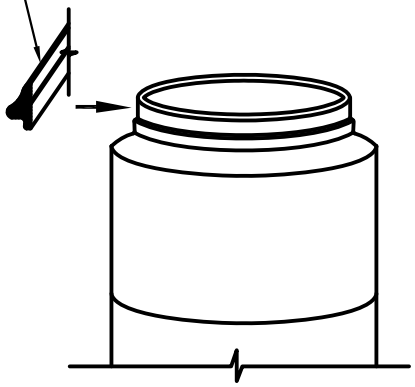


NOTE:
MANHOLE SECTION ANCHOR ASSEMBLIES SHALL BE INSTALLED BETWEEN ALL PRECAST RISER SECTIONS AT EVERY MANHOLE WHERE BOLT DOWN MANHOLE IS SPECIFIED.

MANHOLE JOINT STRAP DETAIL

N.T.S.

TYLOX–SUPER SEAL PRELUBRICATED GASKET TO BE PLACED FIRMLY AGAINST THE OFFSET ALL THE WAY AROUND THE SPIGOT OF THE MANHOLE.



PRECAST MANHOLE

N.T.S.

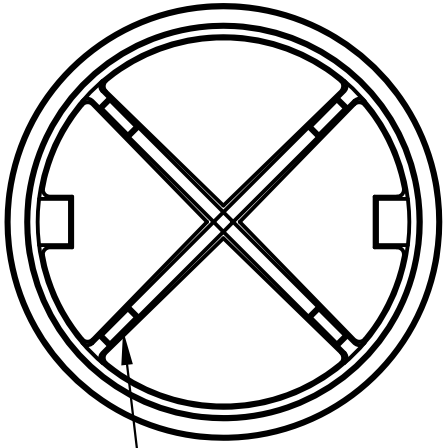
JEFFERSON COUNTY ALABAMA
ENVIRONMENTAL SERVICES DEPARTMENT

PRECAST MANHOLE JOINT DETAILS

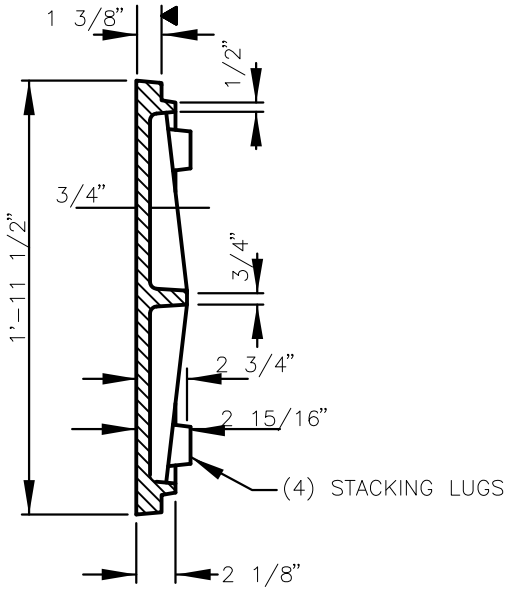
NOV. 1999

APPROVED: _____

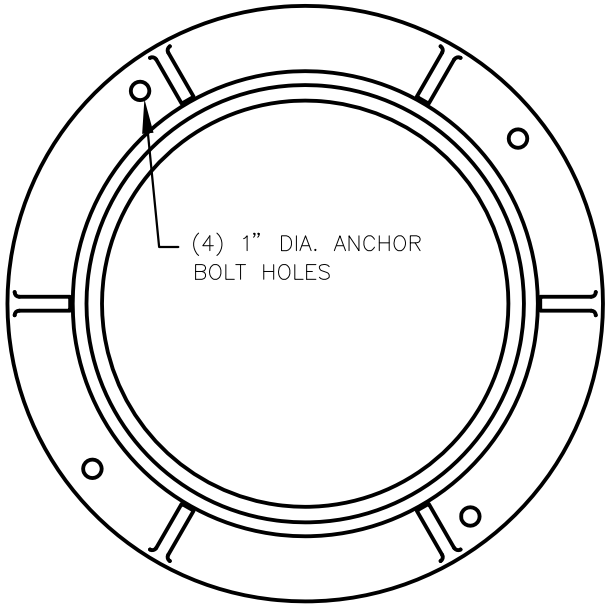
STANDARD DRAWING NO. SD1515



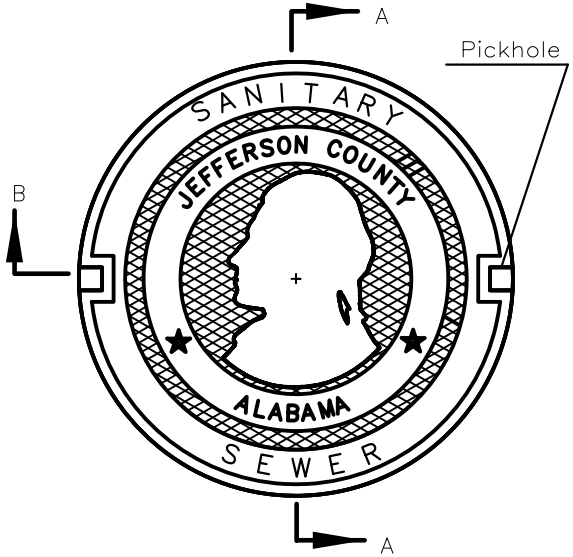
COVER BACK
N.T.S.



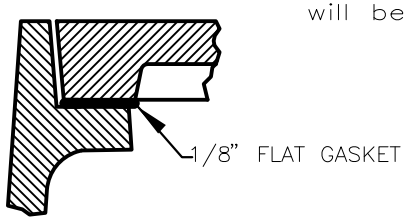
SECTION A-A
N.T.S.



▼ MACHINED BEARING SURFACE

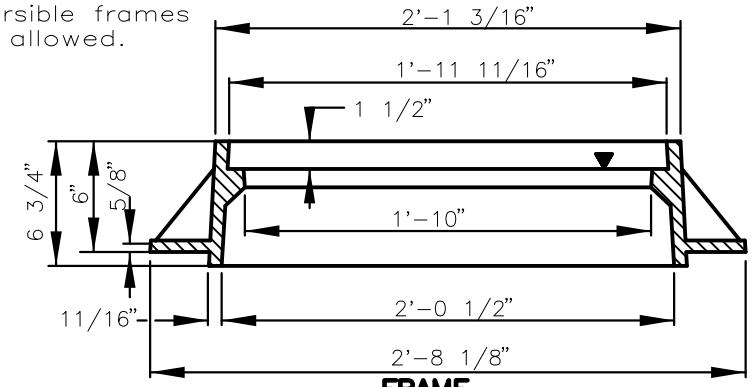


COVER TOP
N.T.S.

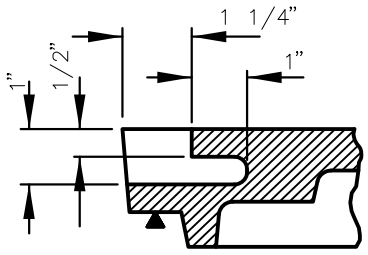


GASKET DETAIL
N.T.S.

NOTE:
No reversible frames will be allowed.



FRAME
N.T.S.



(2) TYPE TWO NON-PENETRATING PICKHOLES

PICKHOLE DETAIL
N.T.S.

ESTIMATED WEIGHTS

FRAME	174 LBS.
COVER	124 LBS.

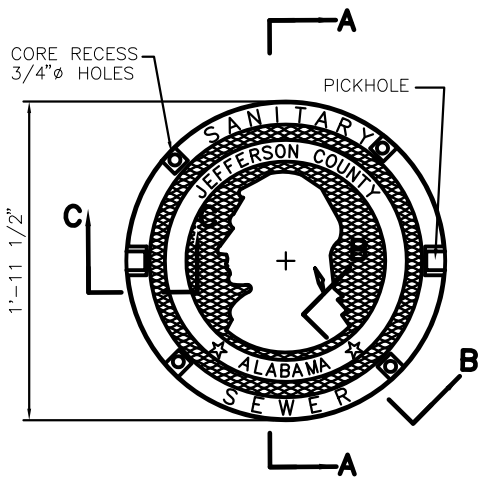
JEFFERSON COUNTY ALABAMA
ENVIRONMENTAL SERVICES DEPARTMENT

STANDARD MANHOLE
FRAME & COVER DETAILS

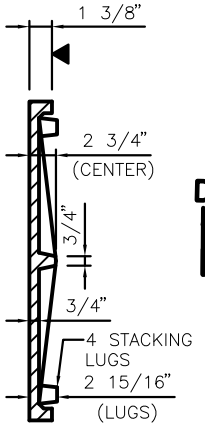
NOV. 1999

APPROVED:_____

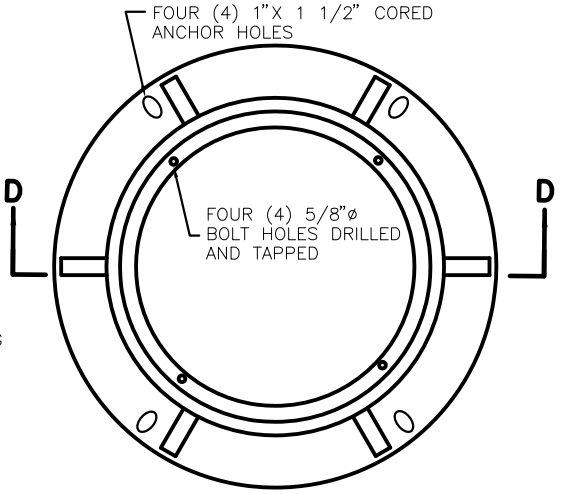
STANDARD DRAWING NO. SD1570

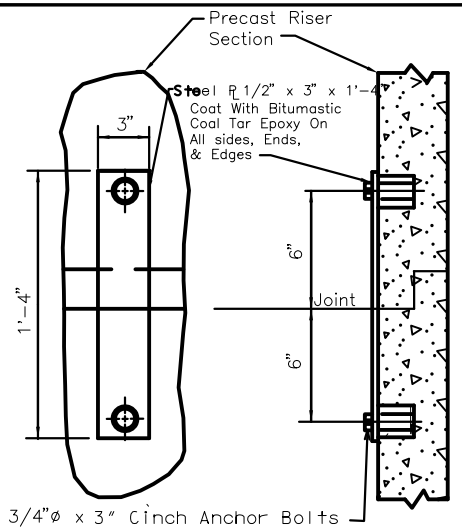


COVER
N.T.S.



SECTION A–A



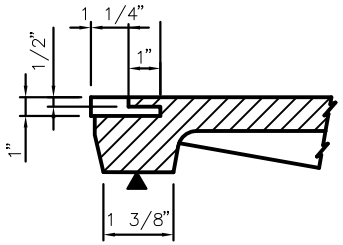


3/4"ø x 3" Cinch Anchor Bolts
2'Unit, Type 2, Coat Heads Of
Bolts With Bitumastic Coal Tar
Epoxy Before Backfill.

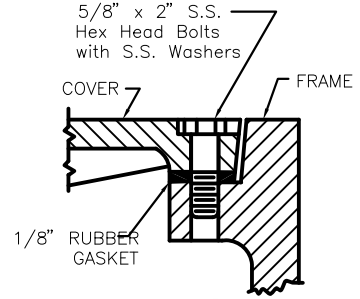
SECTION F–F

SECTION G–G

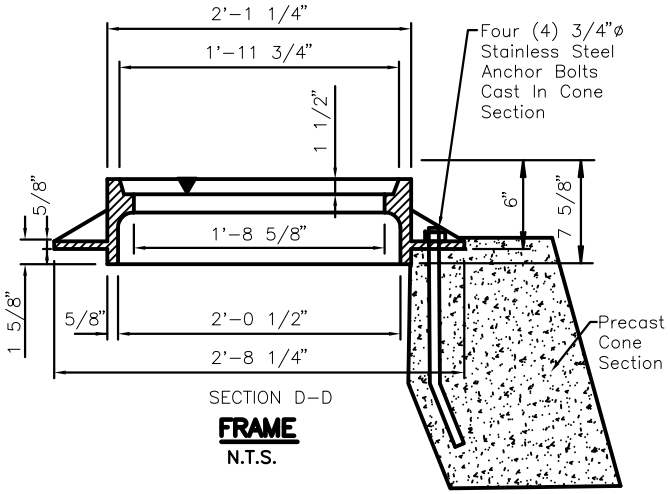
NOTE: 3 Anchor Assemblies Required
Per Joint 120° Apart.



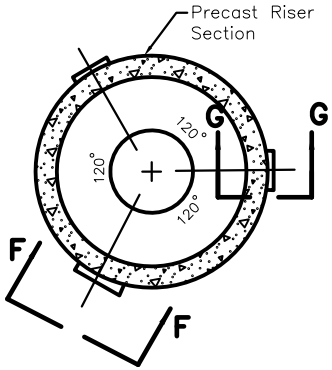
SECTION C–C
PICKHOLE DETAIL
N.T.S.



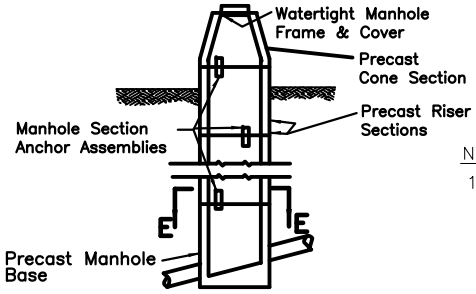
SECTION B–B
WATERTIGHT DETAIL
N.T.S.



SECTION D–D
FRAME
N.T.S.



SECTION E–E
TYPICAL MANHOLE SECTION ANCHOR



ESTIMATED WEIGHTS

FRAME	200 LBS.
COVER	105 LBS.

NOTES:

1. Manhole Section Anchor Assemblies Shall be Installed Between All Precast Riser Sections At every Manhole Bolt down frame and cover Are Specified.

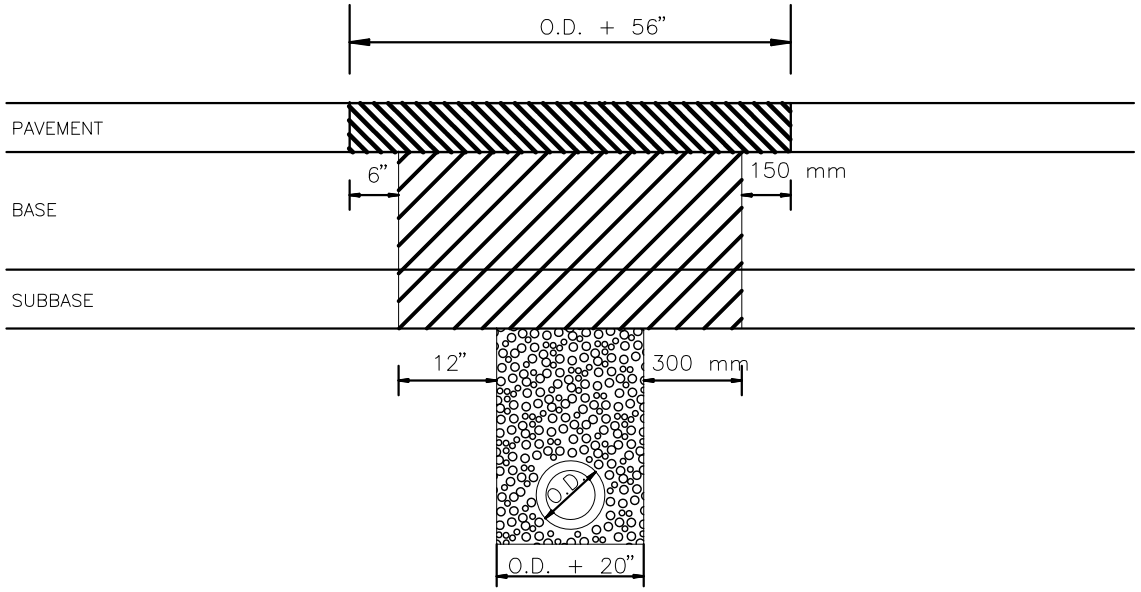
JEFFERSON COUNTY ALABAMA
ENVIRONMENTAL SERVICES DEPARTMENT

BOLT DOWN MANHOLE FRAME & COVER DETAILS

NOV. 1999

APPROVED: _____

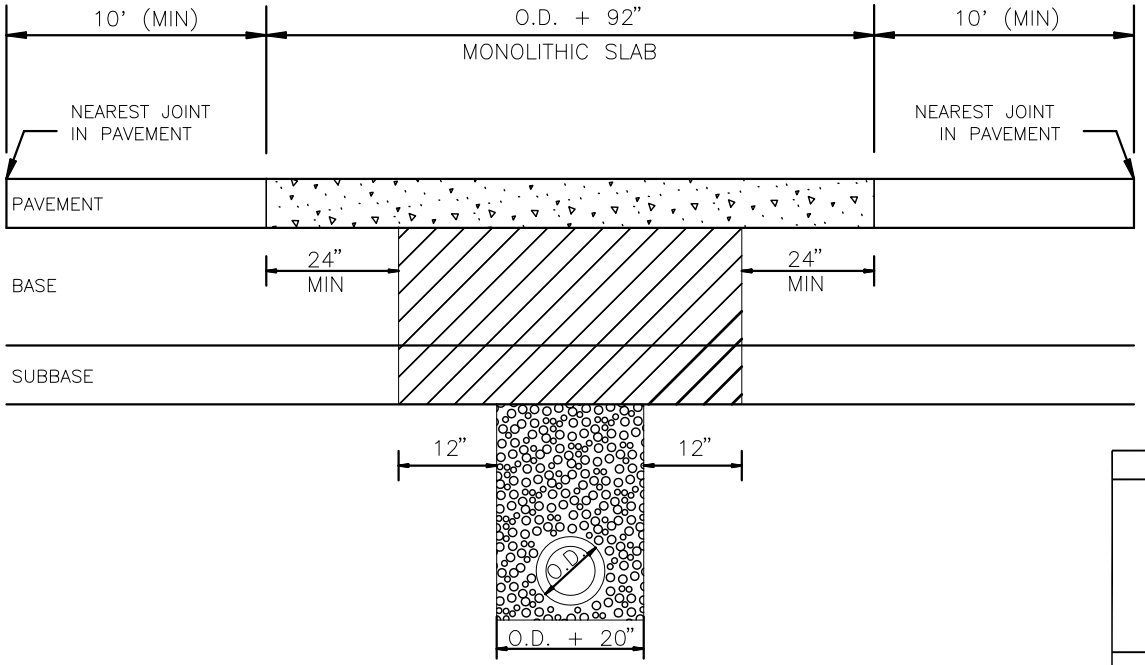
STANDARD DRAWING NO. SD1575



(A) FLEXIBLE PAVEMENT

GENERAL NOTES:

1. ASPHALT CONCRETE PAVEMENT JOINTS SHALL BE MECHANICALLY SAWED.
2. SURFACE TREATMENT PAVEMENT JOINTS SHALL BE LAPPED AND FEATHERED

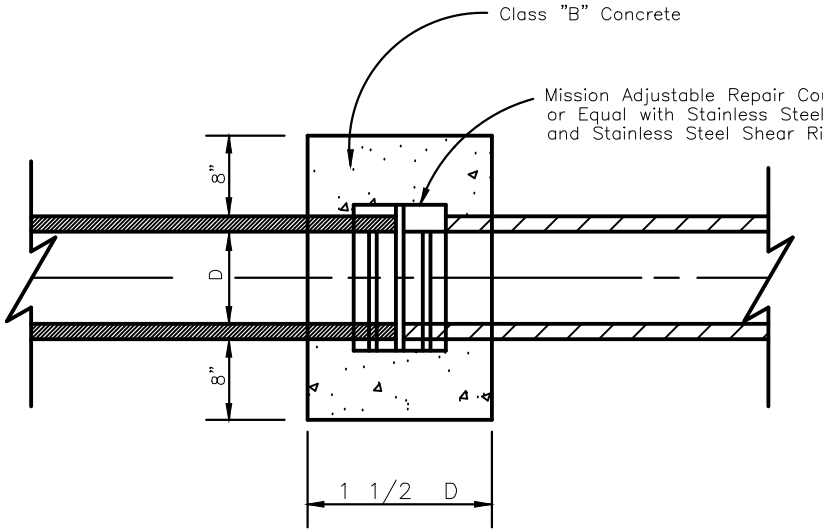


(B) RIGID PAVEMENT

GENERAL NOTES:

1. 3000 PSI CONCRETE, HIGH EARLY CEMENT, TO BE USED FOR PAVEMENT REPLACEMENT
2. JOINTS TO BE MECHANICALLY SAWED.
3. IF REINFORCED, REINFORCING STEEL TO BE REPLACED IN KIND. LONGITUDINAL STEEL TO BE BUTT WELDED TO EXISTING.

	JEFFERSON COUNTY ALABAMA **ENVIRONMENTAL SERVICES DEPARTMENT**
	REPLACEMENT OF ROADWAY STRUCTURE **(WHERE PERMISSION HAS BEEN GRANTED FOR TRENCHED CROSSING)**
NOV. 1999	**ALABAMA DEPARTMENT OF TRANSPORTATION**
APPROVED: _____	STANDARD DRAWING NO. SD2035 RCC

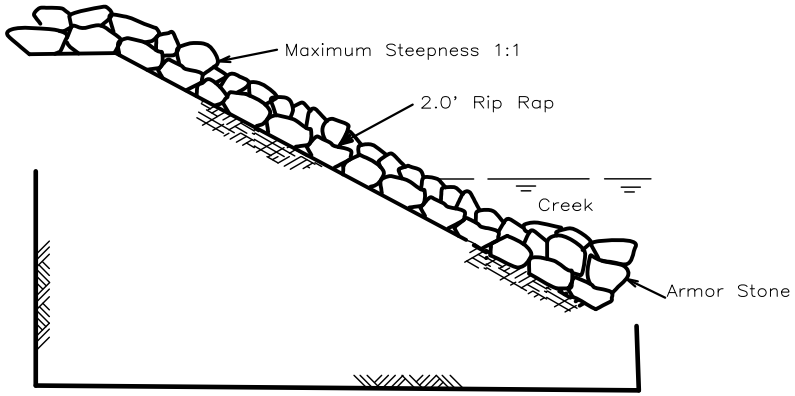


TYPICAL CONCRETE COLLAR

PIPE SIZES 12" OR LESS

N.T.S.

	JEFFERSON COUNTY ALABAMA **ENVIRONMENTAL SERVICES DEPARTMENT**
	DETAILS OF CONCRETE COLLARS
NOV. 1999	
APPROVED: _____	STANDARD DRAWING NO. SD2060



TYPICAL SLOPE PROTECTION
(Rip Rap)

NOTES:

1. Special Slope Protection of various points along existing stream banks may be required at the option of the Engineer to insure the stability of the sanitary sewer pipe and manholes.

2. Stone for channel protection Rip Rap shall be selected stone from rock cuts or other approved sources or pieces of concrete. It shall consist of well graded stones weighing from 10 pounds to 200 pounds each with at least 50% weighing over 80 pounds. Both width and thickness shall be at least 1/3 the length for each stone. Not more than 10% by total weight shall weigh less than 10 pounds and not more than 10% by total weight shall weigh more than 200 pounds.

DATE	REVISIONS	JEFFERSON COUNTY ALABAMA ENVIRONMENTAL SERVICES DEPARTMENT
		SLOPE PROTECTION DETAILS
NOV. 1999		
APPROVED:_____		STANDARD DRAWING NO. SD2500

APPENDIX B

ALABAMA DEPARTMENT OF TRANSPORTATION PERMIT

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ALABAMA
DEPARTMENT OF TRANSPORTATION

THIRD DIVISION
OFFICE OF DIVISION ENGINEER
1020 BANKHEAD HWY., WEST
P.O. BOX 2745
BIRMINGHAM, ALABAMA 35202-2745
Telephone: 328-5820

DON SIEGELMAN
GOVERNOR

G. M. ROBERTS
TRANSPORTATION DIRECTOR

February 9, 1999

Jefferson County Commission
202-B Courthouse
Birmingham, AL 35263-0044

Re: Jefferson County
Permit No. 3-1-3982
M. S. No. Jefferson County

Dear Sir:

Attached is your approved copy of the referenced permit.

Before starting any operation that is close to underground utilities the applicant is responsible for notifying the underground facility operator or a "One Call Notification System" at least 2 days prior to start of operations. If applicant or his agents damages underground facilities without prior notification they are subject to a civil penalty up to $10,000.00 as stated in State Act S.299 Section 10(a).

As required by the Alabama Department Standards for Accommodating Utilities on Highway Rights of Way, would you please notify Mr. Ralph Smith of this office at 205/581-5704 twenty-four (24) hours prior to beginning work and 48 hours prior to working on weekends. Also notify this office upon completion of the work.

Your cooperation is appreciated.

Yours truly,

A. Michael Mahaffey

A. Michael Mahaffey
District Engineer

LSH
Attachment
cc: File

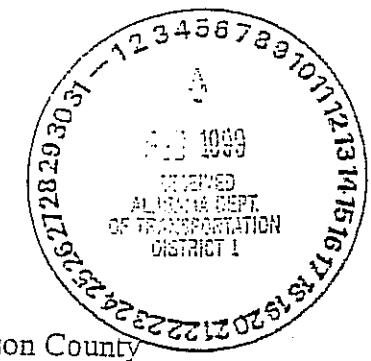
ALABAMA
DEPARTMENT OF TRANSPORTATION

THIRD DIVISION
OFFICE OF DIVISION ENGINEER
1020 BANKHEAD HWY., WEST
P.O. BOX 2745
BIRMINGHAM, ALABAMA 35202-2745
Telephone: 328-5820

DON SIEGELMAN
GOVERNOR

G. M. ROBERTS
TRANSPORTATION DIRECTOR

February 4, 1999



Mr. A. Michael Mahaffey
District Engineer
Alabama Department of Transportation
1020 Bankhead Highway, West
Birmingham, Alabama 35204

RE: Jefferson County
Utility Permit No. 3-1-3982
Jefferson County Commission
Environmental Services
Department

Dear Mr. Mahaffey:

Attached is an approved copy of the above referenced utility permit. This approval covers county wide rehabilitation of the County Commission's existing sanitary sewer systems along various routes provided that all associated work that is within the Department's highway rights-of-way meets all ALDOT requirements.

This blanket approval does not cover work considered to be under the Maintenance Bureau's jurisdiction or level of approval.

The Commission should be reminded that no work shall commence without prior review and approval from the Department.

This is for your use and further handling with Jefferson County Commission.

Sincerely,

James F. Horsley
Division Engineer

JFH/LJR/dmr
C: Mr. W. R. Davis
File

ALABAMA DEPARTMENT OF TRANSPORTATION
1409 Coliseum Boulevard, Montgomery, Alabama 36130-3050

Don Siegelman
Governor

G. M. Roberts
Transportation Director

January 28, 1999

To: Mr. James F. Horsley, Third Division Engineer
Alabama Department of Transportation
P.O. Box 2745
1020 Bankhead Hwy., West
Birmingham, Al 35202

Reference: Utility Permit 3-1-3982
Jefferson County Commission, Environmental Services Department

Attention: Mr. William R. Davis, Division Maintenance Engineer

Dear Mr. Horsley:

Please find attached an approved copy of the above referenced permit application for your use and further handling. Please be aware that this permit does not authorize any work on Interstate right-of-way without prior review and approval from this office.

If you should have any questions or comments please feel free to contact this office at (334) 242-~~6474~~ 6272

Sincerely;

John Lorentson
State Maintenance Engineer

JL/dep2

JEFFERSON COUNTY COMMISSION

GARY WHITE - PRESIDENT
MARY M. BUCKELEW
BETTYE FINE COLLINS
JEFF GERMANY
CHRIS McNAIR

CHRIS McNAIR — COMMISSIONER
Environmental Services

Environmental Services Department
202-B Courthouse
Birmingham, Alabama 35263-0044
Telephone (205) 325-5801

December 4, 1998

Mr. James F. Horsley, P.E.
Division Engineer
Alabama Department of Transportation
Post Office Box 2745
Birmingham, AL 35202

ATTN: A. Michael Mahaffey, P.E.

RE: ALDOT Blanket Construction Permit for Jefferson County Sanitary Sewer Rehabilitation

Dear Mr. Horsley:

Enclosed, as discussed, are "Blanket" Permit Agreements for Jefferson County Sanitary Sewer Rehabilitation to satisfy Consent Decree requirements. The agreements have been executed by the Jefferson County Commission.

Should you have questions or require clarifications, please give me a call at 325-5980.

Sincerely,

Ronald K. Wilson

Ronald K. Wilson, P.E.
Project Manager

RKW/mo

REVISED
12-05-96

ALABAMA DEPARTMENT OF TRANSPORTATION
"Blanket" Permit Agreement for the Repair, Rehabilitation and/or Improvement of Utility Facilities on Public Right-of-Way

Project Number _____
Permit No. 3-1-3982
P.E. _____
R.O.W. _____
Utilities _____
Construction _____
Maintenance Section Jefferson County
Location of Accommodation:
Kilometer post _____ to _____

THIS AGREEMENT is entered into this the ____ day of _____, 19___, by and between the Alabama Department of Transportation acting by and through its Transportation Director hereinafter referred to as the STATE and _____ a Utility hereinafter referred to as the APPLICANT.

WITNESSETH

WHEREAS, the APPLICANT desires to acquire a "Blanket" Permit for the maintenance, repair, rehabilitation, replacement and/or improvement of its facilities accommodated on public highway right-of-way in Jefferson County, Alabama, said project or maintenance section being designated as The Jefferson County Sanitary Sewer Rehabilitation Program and consisting approximately of the following: Sewer re-lining using trenchless methods, manhole rehabilitation, mainline point repairs, service lateral reconnection and repair, mainline replacement, manhole replacement and installation, and other repairs and improvements to meet Consent Decree requirements. All site restoration will be performed in accordance with ALDOT specifications. (See Attached)

WHEREAS, the STATE hereby grants to the APPLICANT approval to cross or locate its facilities on the public right-of-way at the location and in the manner hereinafter set forth:

NOW, THEREFORE, it is agreed by and between the parties hereto as follows:

1. The APPLICANT will repair, rehabilitate and/or improve its facilities on public right-of-way in accordance with plans and specifications of the APPLICANT as approved by the STATE which plans and specifications are hereby made a part hereof by reference.

2. In the repair, rehabilitation and/or improvement of facilities and performing work under this agreement, the APPLICANT will conform to the provisions of the latest edition of the Alabama Department of Transportation Utility Manual, which manual is of record in the Department of Transportation and is hereby a part hereof by reference.

3. The national Manual on Uniform Traffic Control Devices, latest edition, is hereby made a part hereof by reference and will be conformed to as the provisions thereof are applicable to such work. Such Manual is of record in the Alabama Department of Transportation at the execution of this Agreement.

4. The Clean Water Act, 1987 and the Alabama Nonpoint Source Management Program, 1989 are hereby made a part hereof by reference and will be conformed to by the APPLICANT as the provisions thereof are applicable hereto.

The APPLICANT will conform to the regulations of the Environmental Protection Agency (EPA) and of the Alabama Department of Environmental Management (ADEM), latest edition, for both installation and maintenance of such facilities.

5. If hazardous materials, wastes, substances, or as otherwise defined by Code of Alabama§6-5-332.1 (a)(2)(1993 Repl. Vol.) are encountered in the execution of this Agreement it will be the responsibility of the APPLICANT to notify the proper agency responsible for said hazardous materials and to comply with any and all environmental regulations as established by the Environmental Protection Agency (EPA), Alabama Department of Environmental Management (ADEM), and of the Occupational Safety and Health Administration (OSHA) in the proper disposition of the hazardous materials encountered.

6. The APPLICANT will file with the STATE an acceptable certified check or bond in the penal amount of $ 2 to guarantee the faithful performance of this permit contract in it's entirety. Upon satisfactory completion and acceptance of all work provided for in this permit contract, the check or bond, as applicable, will be returned to the APPLICANT; otherwise, the proceeds from the check, or any amount received by the STATE as a result of the bond, will be applied to complete and fulfill the permit contract terms.

7. Reimbursement for future relocations of the APPLICANT's facilities will be in accordance with State law in effect at the time such relocations are made.

8. The APPLICANT will be obligated for the payment of damages occasioned to private property, public utilities or the general public, caused by the legal liability (in accordance with Alabama and/or Federal law) of the APPLICANT, its agents, servants, employees or facilities.

9. The APPLICANT will have a copy of this Agreement on the project site at all times while said work is being performed.

10. Nothing contained in this Permit Agreement, nor the issuance or receipt thereof, shall be construed to alert or affect the title of the STATE to the public right-of-way nor to increase, decrease or modify in any way the rights of the APPLICANT provided by law with respect to the construction, operation or maintenance of its facilities on the public right-of-way.

11. The repair, rehabilitation and/or improvement of the facilities and related work covered by this Agreement shall be completed within one year from the date the work is begun, otherwise this Agreement becomes null and void. Once work is begun the APPLICANT shall pursue the work continuously and diligently until completion.

12. The APPLICANT will perform or cause to be performed the work applied for in this permit contract and will restore the highway in the work area in as good condition as the same was prior to the work and will maintain the accomplished work and highway work area in condition satisfactory to the Alabama Department of Transportation for a period of one year from acceptance by the Department of the completion of work applied for by APPLICANT.

13. The APPLICANT stipulates that the specific use of these facilities located upon public right-of-way is for transport of domestic wastewater.

APPLICANT further stipulates that should this specific use change at any time in the future that the APPLICANT will notify the STATE immediately of the change.

14. THE APPLICANT IS NOT TO PERFORM ANY WORK ON INTERSTATE RIGHT-OF-WAY WITHOUT PRIOR WRITTEN PERMISSION FROM THE ALABAMA DEPARTMENT OF TRANSPORTATION.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by their respective officers, officials and persons thereunto duly authorized, to be effective on the day and year first above stated.

WITNESS:

JEFFERSON COUNTY COMMISSION
(Legal Name of Applicant)

By: _____
(Signature and Title)

APPROVED AS TO FORM:

Gary White
(Typed or Printed Name)

By: _____
Counsel,
Alabama Department of Transportation

President
(Typed or Printed Title)

c/o Ronald K. Wilson, P.E.
Project Manager
Environmental Services Department
(Address)

RECOMMENDATION FOR APPROVAL:

(205) 325-5980
(Telephone)

By: _____
District Engineer

ALABAMA DEPARTMENT OF TRANSPORTATION
ACTING BY AND THROUGH ITS
TRANSPORTATION DIRECTOR

By: _____
Division Engineer

By: _____
Maintenance Engineer

APPROVED BY THE
JEFFERSON COUNTY COMMISSION
DATE: 12-2-98
MINUTE BOOK: 123
PAGE(S): 96-98

JEFFERSON COUNTY COMMISSION

MARY M. BUCKELEW - PRESIDENT
BETTYE FINE COLLINS
JEFF GERMANY
CHRIS MCNAIR
GARY WHITE

CHRIS McNAIR — COMMISSIONER
Environmental Services

Environmental Services Department
202-B Courthouse
Birmingham, Alabama 35263-0044
Telephone (205) 325-5801

November 2, 1998

Mr. James F. Horsley
Division Engineer
Alabama Department of Transportation
Post Office Box 2745
Birmingham, AL 35202

RE: ALDOT Blanket Construction Permit for
Jefferson County Sanitary Sewer Rehabilitation

Dear Mr. Horsley:

As you are aware, the Jefferson County Environmental Services Department, under the auspices of the Jefferson County Commission, is currently in the process of rehabilitating sanitary sewers in Jefferson County. This work is required as a result of a Consent Decree executed by Jefferson County, the U.S. Environmental Protection Agency and the Justice Department, local citizen plaintiffs R. Allen Kipp, Jr., et., al., and the Cahaba River Society and involves work on an estimated 12,000,000 linear feet (approx. 2,300 miles) of sanitary sewer. The County anticipates that over 125 projects will be let for construction under this program at a cost of over 500 million dollars. The total program, which also includes wastewater treatment plant upgrades and major sewer replacements, is projected to cost in excess of 1.2 billion dollars. The County is currently bidding sewer rehabilitation projects on a four (4) week schedule with lag time between projects to decrease to three (3) weeks by November, 1999. The critical path for completion of this work is September 1, 2006 and encompasses work in our largest system, the Valley Creek Basin.

Obviously, to successfully complete a program of this scope and magnitude requires the cooperation of many entities and jurisdictions. As discussed in our October 28, 1998 meeting with you and your staff, a blanket ALDOT permit for sewer rehabilitation work within state highway right-of-way is undoubtedly the most prudent and effective way to allow this work to proceed in a timely manner, to

allow it to remain on schedule and to avoid the imposition of stipulated penalties by the EPA for exceeding specified deadlines. Therefore, our request for a "blanket permit" for this work is hereby submitted.

As agreed upon in our meeting, the County, through it's design engineer USInfrastructure, Inc., will provide the ALDOT Third Division-District 1 office with detailed drawings of all work to be performed within state highway right-of-way prior to the onset of that work. The County will also require it's contractor to notify the ALDOT a minimum of 48 hours prior to commencing with the work. As discussed, work to be performed on existing sewers already located within state highway rights-of-way will be considered to be maintenance related. This work will primarily be trenchless in nature, but will also include mainline point repairs, service lateral repairs, mainline replacements, repairs to mainline connections at manholes, and manhole replacements and/or installations. Where practical, mainline replacements will be relocated to areas away from the pavement. All work will be performed in accordance with ALDOT specifications and your office will be furnished with as-constructed drawings once work is completed.

Your issuance of a "blanket permit" for Jefferson County sanitary sewer rehabilitation within state highway right-of-way is requested at your earliest convenience. Should you have questions or require additional information, please give me a call at 325-5980.

Sincerely,

Ronald K. Wilson

Ronald K. Wilson, P.E.
Project Manager

RKW/mo

cc: A. Michael McNaffey, Alabama Department of Transportation
Jack W. Swann, Director
Environmental Services Department
Mike Eddington, USInfrastructure, Inc.
Clarence Barber, Jefferson County Construction Superintendent

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APPENDIX C

JEFFERSON COUNTY ENVIRONMENTAL SERVICES DEPARTMENT MBE/DBE FORMS

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FORM "A"

JEFFERSON COUNTY, ALABAMA
ENVIRONMENTAL SERVICES DEPARTMENT

POTENTIAL SUBCONTRACTORS LIST
(TO BE SUBMITTED WITH BID DOCUMENTS)

MBE/DBE DOCUMENTATION

GENERAL CONTRACTOR:_____

CONTACT:_____

NAME OF PROJECT:_____

DATE SUBMITTED:_____

List Each MBE/DBE Firm Submitting Proposals	Scope of Work	Proposal Amount ($)

Instructions:

1. Complete this form regarding the MBE/DBE Firms submitting proposals on the specified project.
2. Submit completed form WITH BID DOCUMENTS.
3. Submission of Form "A" is a prerequisite to awarding the Contract.

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FORM "B"

JEFFERSON COUNTY, ALABAMA
ENVIRONMENTAL SERVICES DEPARTMENT

SUBCONTRACTORS TO BE UTILIZED
(TO BE SUBMITTED PRIOR TO CONTRACT AWARD)

MBE/DBE DOCUMENTATION

GENERAL CONTRACTOR: _____

CONTACT: _____

NAME OF PROJECT: _____

TOTAL CONTRACT AMOUNT $_____

TOTAL AMOUNT OF ALL SUBCONTRACTORS $_____

DATE SUBMITTED: _____

List Each MBE/DBE Subcontractor to be Utilized	Scope of Work	Contract Amount ($)
	TOTAL	

Instructions:

1. Complete this form regarding the MBE/DBE participation to be utilized on the specified project.
2. Submit completed form prior to contract award.
3. Submission of Form "B" is a prerequisite to awarding the Contract.

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FORM "C"

JEFFERSON COUNTY, ALABAMA
ENVIRONMENTAL SERVICES DEPARTMENT

MONTHLY REPORT FORM
(TO BE SUBMITTED WITH EACH MONTHLY PAYMENT REQUEST)

MBE/DBE DOCUMENTATION

GENERAL CONTRACTOR:_____

CONTACT:_____

NAME OF PROJECT:_____

TOTAL CONTRACT AMOUNT $_____

SUBMITTED WITH PAYMENT REQUEST NUMBER _____

DATE SUBMITTED:_____

List Each MBE/DBE Subcontractor Utilized	Original Subcontract Amount ($)	BILLINGS		
		Previous ($)	This Period ($)	Total ($)
Totals				

Instructions:

1. Complete this form regarding the MBE/DBE participation utilized on the specified project.
2. Submit completed form with each monthly payment request to Environmental Services Department.
3. Submission of this form is a prerequisite for processing the monthly payment request.

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FORM "D"

JEFFERSON COUNTY, ALABAMA
ENVIRONMENTAL SERVICES DEPARTMENT

PROJECT CLOSE-OUT REPORT

MBE/DBE DOCUMENTATION

GENERAL CONTRACTOR:_____

CONTACT:_____

NAME OF PROJECT:_____

TOTAL CONTRACT AMOUNT $_____
(BID AMOUNT)

FINAL CONTRACT AMOUNT $_____
(FINAL AMOUNT INCLUDING CHANGE ORDERS)

DATE SUBMITTED:_____

List Each MBE/DBE Subcontractor Utilized	Original Subcontract Amount ($)	Final Subcontract Amount ($)	Changes in Original and Final Subcontract Amounts ($)
Totals			

Instructions:

1. Complete this form regarding the MBE/DBE participation utilized upon completion of the specified project.
2. Submit completed form to Environmental Services Department with request for release of retainage.

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ENVIRONMENTAL SERVICES DEPARTMENT (ESD)
MBE/DBE BID SOLICITATION NOTICE

FORM "E"

ESD PROJECT: _____
LOCATION: _____
BID DATE: _____

To: Birmingham Construction Industry Authority (BCIA)
3600 4th Avenue South
Birmingham, Alabama 35222
BCIA Fax: 205/324-6210
ESD Fax: 205/325-5981

We hereby request assistance from the BCIA in securing proposals from MBE/DBE Subcontractors/ Suppliers per the below listing of construction specialties. In order to be considered, proposals must be received in the Office of the General Contractor on or before the below listed date and time.

Please contact the following for additional information and assistance:

General Contractor/Contact: _____
Address: _____

_____

Telephone: _____ Fax: _____

DEADLINE FOR RECEIPT OF PROPOSALS FROM MBE/DBE'S

Date:_____ Time:_____

_____
General Contractor Signature and Date

FOR BCIA USE ONLY

Date Received:_____
By:_____

Check all categories that apply to the referenced project:

( ) Demolition
( ) Dewatering
( ) Geotechnical Work
( ) Material Testing
( ) Site Clearing and Grubbing
( ) Grading/Earthwork
( ) Erosion Control/Silt Fence
( ) Fencing
( ) Grassing
( ) Landscaping/Planting
( ) Asphalt Paving
( ) Pavement Striping/Marking
( ) T.V. Inspection
( ) Prep Manholes for Rehabilitation
( ) Pipe Point Repairs
( ) Hauling/Trucking
( ) Concrete Curb & Gutter
( ) Concrete Sidewalks
( ) Pour & Finish Concrete Flat Work
( ) Concrete Formwork
( ) Install Reinforcing Steel
( ) ~~Point~~, Patch & Rub Concrete
( ) Cementious Coatings
( ) Masonry Work
( ) Wood Cabinets
( ) Asphalt Shingle Roofing
( ) Built-up Roofing
( ) Metal Roofing
( ) Gutters and Downspouts
( ) Waterproofing/Dampproofing
( ) Insulation
( ) Glass & Glazing
( ) Gypsum Wall Board System
( ) Ceramic/Quarry Tile
( ) Resilient Flooring
( ) Acoustical Ceilings
( ) Carpet
( ) Wall Coverings
( ) Painting
( ) HVAC
( ) Plumbing
( ) Electrical
( ) Underground Duct Banks
( ) Material Supply
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APPENDIX D

State of Alabama Resident Status Form

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JEFFERSON COUNTY, ALABAMA
ENVIRONMENTAL SERVICES DEPARTMENT

STATE OF ALABAMA RESIDENT STATUS FORM

_____ is a Resident Contractor in the State of Alabama as defined
Individual or Firm Name of Bidder in Section 39-2-12, Code of Alabama (1975) as amended.

_____ is a Non-Resident Contractor in the State of Alabama.
Individual or Firm Name of Bidder

THE ATTENTION OF BIDDERS IS CALLED TO THE PROVISIONS OF ALABAMA CODE SECTION 39-3-5 (1975) AS AMENDED, REGARDING PREFERENCE TO RESIDENT CONTRACTORS.

Instructions:

1. **Submit this form regarding State of Alabama Resident Status WITH BID DOCUMENTS**
2. **Submission of this form is a prerequisite to awarding the Contract.**

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APPENDIX E

Jefferson County, Alabama

Equal Employment Opportunity Certification Form

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ADMINISTRATIVE ORDER
OF THE
JEFFERSON COUNTY COMMISSION
08- 4

PURSUANT to the authority vested in the Jefferson County Commission by law, the following Administrative Order is hereby issued:

PURPOSE

To give notice to potential contractors that Jefferson County is an equal opportunity employer in accordance with Title VII, Civil Rights Act of 1964, 42 U.S.C. §§ 1981, 1983, 1986 and amendments, and it is the policy of Jefferson County to require contractors, vendors and suppliers (hereinafter "Contractor") providing goods and services to the County to afford equal opportunity for employment to all individuals regardless of race, color, sex, age, religion, national origin, disability or veteran status.

I. PROCEDURE

The clause set forth below which requires Contractor compliance with federal law shall be incorporated in each bid or offer to do business with the County and in all contracts and subcontracts with the County as follows:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin, age, disability or veteran status pursuant to the provisions of Title VII of the Civil Rights Act of 1964, 42 U.S.C. § § 1981, 1983, 1986 and all amendments thereto relative to discriminatory employment practices. The Contractor will ensure that qualified applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, national origin, age, disability or veteran status. Such action shall include, but not be

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limited to the following: employment, promotion, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

2. In the event of the Contractor's non-compliance with the equal employment opportunity clause of this contract, this contract may not be awarded or may be cancelled, terminated or suspended in whole or in part and the Contractor may be declared ineligible for further County contracts.

3. The Contractor will include the provisions of paragraph (1) in every subcontract or purchase order.

4. The Contractor shall certify to the County its compliance with this policy prior to receipt of any contract or business with the County. (Form attached.)

II. **EFFECTIVE DATE**

This Administrative Order shall be effective upon adoption.

ORDERED at the Jefferson County Courthouse this 17 day of June, 2008.

Bettye Fine Collins

BETTYE FINE COLLINS, President
Jefferson County Commission

APPROVED BY THE
JEFFERSON COUNTY COMMISSION
DATE: 6-17-08
MINUTE BOOK: 156
PAGE(S): 128-129

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JEFFERSON COUNTY, ALABAMA
EQUAL EMPLOYMENT OPPORTUNITY CERTIFICATION FORM

Contractor/Vendor Name: _____

Address: _____

_____

_____

The Contractor acknowledges receipt of Jefferson County's Equal Employment Opportunity Contractor Compliance Administrative Order (attached hereto) and certifies that it is an equal opportunity employer and agrees to the requirements of the Policy and the Equal Employment Opportunity Clause therein. It further certifies that it will require all subcontractors to execute an Equal Employment Opportunity statement and certification of compliance.

The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin, age, disability or veteran status. The Contractor will ensure that qualified applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, national origin, age, disability or veteran status. Such action shall include, but not be limited to the following: employment, promotion, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this non-discrimination clause.

The Contractor will furnish to the County, upon request, reports, notices, policies and/or information certifying compliance with this policy.

In the event of the Contractor's non-compliance with the equal employment opportunity clause of this contract, this contract may not be awarded or may be cancelled, terminated or suspended in whole or in part and the Contractor may be declared ineligible for further County contracts.

_____ _____

Date Signature

_____

Title

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APPENDIX F

Article H, Excavations- General Code of the City of Birmingham, 1980 Ordinance No. 10-115

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ORDINANCE NO. 10-115

Section 1. BE IT ORDAINED by the Council of the City of Birmingham, Alabama, that Title 4, "Municipal Services", Chapter 5, "Streets and Sidewalks", Article H, "Excavations", of the General Code of the City of Birmingham, 1980, Sections 4-5-131, 4-5-132, 4-5-133, 4-5-134, 4-5-135, 4-5-136, 4-5-137, 4-5-138, 4-5-139, 4-5-140, 4-5-141, 4-5-142, 4-5-143, 4-5-144 and 4-5-145 are hereby amended, alter, modify and add provisions related to excavations, to required that work be done by a licensed contractor; to provide that contact information be provided by all utilities and/or franchisees; to increase permit fees; to require that a permittee shall restore or caused to be restored pavement for all excavations according to city standards; to require a bond prior to issuance of an excavation permit and circumstances under which it may be waived; to revise time limits in permits; to provide clarifications for the term "utility," where new utilities shall be located, and for utility replacement; to provide that for the restoration of streets, alleys, sidewalks or other public ways by permittee in accordance with city standards, specifications and details; correct clerical errors; to provide for due process rights of permittee; and, otherwise revise; and to provide that an unmarked ordinance containing the amended, altered, modified and additional provisions be substituted and replace the prior language of such sections as heretofore referenced herein in their entirety in the General City Code to read in full as follows:

"Sec. 4-5-131 Permit; required; exceptions.

"(a) It shall be unlawful, except in an emergency as set forth in section 4-5-132, for any person, other than an authorized officer, employee or agent of the city, to make any opening, cut or excavation in or under the surface of any street, alley, sidewalk or public way of the city without having first obtained a permit as provided in this article, or without having first obtained a permit as provided in this article, or without inspection as required by that permit.

"(b) It shall also be unlawful for any person to whom a permit has been issued to do or cause to be done the work authorized therein without also complying with inspection requirements contained in the permit.

"(c) The permittee shall cause the work authorized by a permit issued in accordance with this article to be performed by an entity licensed to do the work for which the permit is issued. All pavement restoration shall be performed by a licensed paving contractor. Proof of licensure shall be presented at the time application for a permit is made or a permit will not be issued.

"Sec. 4-5-132 Same; procedure when utility installation breaks, etc.

"(a) In the event that any sewer, main, conduit or other utility or franchisee installation in or under any street, alley, sidewalk or public way shall burst, break or otherwise be in a condition as seriously to endanger persons or property, the owner of that sewer, main, conduit or other installation shall immediately repair the trouble and shall immediately take all necessary steps to make the location safe and secure. That owner, utility or franchisee shall not, however, begin making any permanent repairs to the street, alley or sidewalk until he shall have secured a permit as provided in this article. A permit shall be secured on the next business day after any break or serious trouble shall have developed, and the necessary repairs to the street, alley or sidewalk shall be made as directed by the city engineer and shall be completed as is set forth in this Sec. 4-5-144.

"(b) It shall be unlawful for any person to cut any pavement under this section unless an emergency shall be of such nature that immediate repair is required for the safety of persons or property or both, and it shall be unlawful for any person to fail to comply with all other provisions of this article, including but not limited to the securing of a permit within the time required and the payment of the special charge and making of permanent restoration in the manner and time required by sections 4-5-133, 4-5-135, and 4-5-144.

"(c) Any and all utilities and/or franchisees shall provide current contact information, including the name of a designated person, address, telephone, cell phone, email or other electronic means of communication to the city engineer to report an emergency repair to be made under this section. Should the city become independently aware of a cut to any pavement under this section, the city shall notify utility or franchisee to comply with permit requirements. Failure to comply shall result in a permit fee of not less than two hundred dollars ($200.00). The contact information described herein shall be made available to the city engineer upon request.

"Sec. 4-5-133 Same; special charge; when required.

"Subject to the provisions of sections 4-5-36, 4-5-134, 4-5-135 and 4-5-144, any person desiring to make or who has under section 4-5-132 made any opening, cut or excavation in or under the surface of any paved, curbed or otherwise improved street, alley or sidewalk for any rightful or necessary purpose to be accomplished speedily and without undue delay in the event the street to be cut or which has been cut has been paved or repaved less than five (5) years next prior to the application for the permit, shall, at the time the excavation permit is applied for and prior to the issuance thereof pay to the city engineer a special charge, to become a part of the general fund of the city, an amount calculated according to the age of the pavement, as follows: During the first twelve (12) months after completion, one thousand dollars ($1000.00); during the second twelve (12) months, eight hundred dollars ($800.00); during the third twelve (12) months, six hundred dollars ($600.00); during the fourth twelve (12) months, four hundred dollars ($400.00); and during the fifth twelve (12) months, two hundred dollars ($200.00).

"Sec. 4-5-134 Same; same; when payment excused.

"In the event that the city engineer shall, in his sound discretion, determine that due to circumstances beyond the control of any person who owns such property as to which notice was mailed as provided in section 4-5-36 which abuts on or is in any street or alley which has been paved or repaved within five (5) years next preceding the application for a pavement cut permit, improvements on the property have been damaged or destroyed in such a manner as to require a permit for a pavement cut to be issued pursuant to the rebuilding or repair of such destroyed or damaged improvements, then the city engineer may issue a permit for such pavement cut without requiring the payment of the special charge provided in section 4-5-133. In no case shall this special charge be required where notice was not mailed as provided in section 4-5-36.

"Sec. 4-5-135 Same; provision to be made for restoration of pavement.

"(a) The permittee shall restore, or cause to be restored, the pavement for all excavations in streets, alleys, sidewalks or other public ways, and curbs and gutters in accordance with the city of Birmingham's standard specifications and details. Said specifications and details are on file in the office of the city engineer.

"(b) The cost of restoration shall be paid by the applicant for the total cost incurred to restore streets, alley, sidewalks or other public ways, and curbs and gutters.

"(c) Prior to the issuance of any permit required by this article, any permittee for whom application for a permit is made to make any opening, cut or excavation in or under the surface of any street, alley, sidewalk or public way of the city shall, in addition to payment of the special charge provided in the section 4-5-133, when the payment is required, deposit with the Department of Finance and continuously maintain a good and sufficient bond in the sum of ten thousand dollars ($10,000) for cuts seventy-five (75) square feet or less or if the cut is greater then seventy-five (75) square feet in an amount to be approved by the city engineer, and made by a surety company duly authorized to do business in Alabama. Said bond shall be conditioned that the person, firm, or corporation, to be known as the principal in said bond, shall observe all ordinances and laws of the City pertaining to said business or businesses, whether now or hereafter enacted, together with all rules and regulations established under the authority of said laws or ordinances; shall perform in a workmanlike manner all work undertaken by said principal in the prosecution of said business or businesses; and shall indemnify and save harmless the said City from all liability occasioned or arising from any activities by said principal, its servants and agents, in any way related to said activities; and shall adequately safeguard all excavations which may be opened by said principal in the streets, alleys, sidewalks and other public ways of said City; and shall restore, or cause to be restored, in accordance with the city of Birmingham's standard specifications and details, all such portions of said streets, alleys and sidewalks and other public ways excavated by said principal is responsible, pay the costs and expenses thereof, and shall pay all such damages as any person, firm, or corporation may sustain by reason the activities by said principal, its servants, or agents, in the prosecution

of said business or businesses. Any person, firm, or corporation injured in person or property by reason of the activities by said principal, or by an act, default, or omission constituting a breach of any of the conditions of this bond, may maintain a suit or action thereon for such injury. Said bond shall also provide that it may be canceled by the surety by giving the city engineer thirty (30) days notice in writing prior to the date of cancellation.

"(d) The bonding requirement in section 4-5-135(c) of this Article is waived if any permittee for whom application for a permit is made has a bond as described in section 4-5-135(c) on file with the Department of Finance.

"(e) The bonding requirements of section 4-5-135(c) shall not apply to departments of the city.

"Sec. 4-5-136 Same; issuance; fee.

"All permits required by this article shall be issued by the city engineer or his or her designee. A permit fee of one hundred dollars ($100.00) shall be paid for each permit prior to issuance, provided that in the event construction is started before a written permit is granted, no permit shall be issued except upon payment of a fee of two hundred dollars ($200.00). The provisions of this section shall apply to all persons alike, whether they are authorized by law or franchise to excavate in or under any of the streets or sidewalks of the city or not.

"Sec. 4-5-137 Same; time limits.

"Any permit issued pursuant to this article shall become null and void in the event work authorized thereunder is not commenced within thirty (30) days after its issuance or in the event a cessation of work continues for twenty-four (24) hours unless a time extension is granted, in writing, by the city engineer or his or her designee.

"Sec. 4-5-138 Use of sewers or utilities prior to restoration of pavement prohibited; exceptions.

"It shall be unlawful for any person, except a public utility corporation, to use or attempt to use any sewer or public utility for which any pavement, sidewalk or curb cut was made until restoration shall have been completed and finally accepted by the city engineer, or his or her designee, where the work is done by a contractor and the cost thereof paid where done by the city.

"Sec. 4-5-139 Excavation under electrical, gas, building and plumbing codes subject to this article.

"All provisions of the electrical code, gas code, building code and plumbing code of the city relating to excavation in streets or alleys, and relating to connections with or use of

sewers and utilities requiring a permit for pavement, sidewalk or curb cuts shall be subject to all applicable provisions of this article.

"Sec. 4-5-140 Obstruction of more than half of street or alley.

"(a) Except as otherwise provided in section 4-5-14 hereof, it shall be unlawful for any person, firm or corporation to engage in any construction project, pavement or excavation in or adjacent to any roadway, street or alley which shall in any way obstruct more than half of the width of the roadway, street or alley any time, measured from curb to curb.

"(b) Any person, firm or corporation engaged in any construction, pavement or excavation for which, due to the nature or extent of the work involved, obstruction is necessary of any portion of a roadway, street or alley either within the Central Business District as defined in section 10-1-1(6), or listed in "Schedule II, Through Streets Designated" as established in section 10-10-1 hereof, may obstruct only such portion of the roadway, street or alley as the city engineer, or his or her designee, may deem necessary and shall obtain a permit therefor as provided herein, except as provided in the Technical Code of the City of Birmingham or this section.

"(c) Requests for permits to obstruct any portion of a roadway, street or alley as referred to in subsection (b) hereof for the purpose of construction, pavement or excavation on or adjacent thereto shall be made on a form to be supplied by the city engineer, or his or her designee, and prior to issuance of the permit, the request shall be reviewed and approved by the city engineer, or his or her designee, and shall be reviewed by the traffic engineer.

"(d) Upon compliance with subsection (c) hereof, a permit shall be issued for a period of time reasonably necessary for the completion of the proposed work and under such restrictions as the issuing and approving authorities may reasonably require for the protection of the public. Such permit may be renewed only upon reapplication and approval.

"(e) A copy of the permit issued pursuant to subsection (d) hereof shall be maintained at the jobsite of the construction, pavement or excavation and shall be produced for inspection by the permittee or his agent or employee in charge upon demand by any authorized city inspector, authorized employee of the city planning, engineering and permits department or traffic engineering department or any city law enforcement officer, any of whom may issue citations for violations of this section.

"(f) Any such obstruction of which no permit has been issued, or which exceeds the limits established in an issued permit, shall be removed immediately upon demand by any of the authorized city employees set out in subsection (e).

"(g) (1) Failure to comply with the permit requirements of this section or (2) failure to comply with any lawful order to remove any unauthorized obstruction shall be punishable in accordance with section 1-1-6, and continued failure to so comply for more than one (1)

day shall be punishable as an act or omission of a continuing character under the provisions of section 1-1-7.

"(h) The provisions of this section, or of any other section of this code or of any building code provision, notwithstanding, the city engineer, or his or her designee, may, at his discretion, authorize temporary obstructions of any street, roadway or alley for a period not to exceed one (1) day for emergency repairs to utilities or streets, and shall have the authority to set limits and conditions on such temporary obstructions as he may deem necessary.

"(i) The provisions of the section further notwithstanding, authorized obstruction of any street, alley or roadway shall comply with any and all other or additional requirements or restrictions contained in this code or any other code governing the activity for which the obstruction is necessary, as well as the traffic regulations of the city.

"Sec. 4-5-141 Duty of persons completing work on unimproved, etc., streets, etc.

"Except as otherwise provided in section 4-5-142, whenever an excavation is made in any unimproved, unpaved or oiled street, alley or sidewalk, or the same is otherwise obstructed, any person doing the same shall forthwith, upon completion of the work thereon, proceed to fill in the excavation, to remove all obstructions and to leave any unimproved, unpaved or oiled street, alley or sidewalk in as good condition as he found it, and free from all irregularities, obstructions or unevenness.

"Sec. 4-5-142 How work performed; materials for backfilling.

"In the event any cut, opening or excavation is made in or under the surface of any street or alley which is already paved or which is about to be paved pursuant to the terms of any existing contract, it shall be the duty of the person making the cut, opening or excavation or causing same to be done and of each agent acting for any such person to perform such works in accordance with standard specifications and details prescribed by the city engineer.

"Sec. 4-5-143 Utility installations.

"(a) *Utility* means any sewer; storm drain; culvert; water main; gas main; telephone line, cable or conduit; fiber optic line, cable or conduit; electric power line, cable or conduit; cable and duct; television cable; service connections; or any other main, line, conduit, cable or duct installed in the right-of-way.

"(b) Utilities, new construction - Utilities shall be installed behind the curb or beyond the edge of pavement in new subdivisions or commercial developments to the maximum extent practical. The city engineer, or his or her designee, may grant a variance from this requirement on a case-by-case basis to account for unusual site conditions. Replacement of existing utilities shall not be considered new construction.

"(c) Utilities, replacement

"1. When existing underground utilities are replaced, the replacement utilities shall be relocated behind the curb or beyond the edge of pavement to the maximum extent practical. The city engineer, or his or her designee, may grant a variance from this requirement on a case-by-case basis to account for unusual site conditions.

"2. The permittee shall, to the maximum extent possible, install or caused to be installed, facilities using technologies that are the least disruptive to the pavement.

"3. The permittee shall, to the maximum extent possible, connect, or cause to be connected, existing service connections to facilities by utilizing technologies that minimize disruption to the pavement and public.

"Sec. 4-5-144 Restoration requirements.

"(a) Restoration of streets, alleys, sidewalks or other public ways.

"1. The permittee shall be responsible for making, or causing to be made, all temporary and permanent pavement repairs. All repairs shall be made in accordance with the city of Birmingham's standard specifications and details. Said specifications and details are on file in the office of the city engineer.

"2. The permittee shall cut, or caused to be cut, the streets, alleys, sidewalks or other public ways to form straight lines and neat rectangular shapes as directed by the city engineer, or his or her designee.

"3. The permittee shall install, or cause to be installed, a temporary repair upon completion of the work authorized by a permit. The permittee shall be responsible for maintaining the temporary repair for a period of thirty (30) days and until the permanent repair is made. If the permittee fails to install or maintain the temporary repair, the bond shall be forfeited and the permittee will not be issued any subsequent permits to excavate in the public right-of-way.

"4. The permittee shall make, or cause to be made, the permanent repair no later than five (5) business days after expiration of the thirty (30) day period cited on section 4-5-144(a)3). If the permittee fails to make the permanent repair within the stated time frame, the bond shall be forfeited and the permittee will not be issued any subsequent permits to excavate in the public right-of-way.

"5. The permittee shall be responsible for maintaining the permanent repair for one (1) year after completion of the permanent repair. The permittee shall commence, or cause to be commenced, maintenance of the permanent repair within five (5) business days of receipt of written notification from the city engineer, or his or her designee, to perform said maintenance. If the permittee fails to maintain the permanent repair within the time period stated, the bond shall be forfeited and the permittee will not be issued any subsequent permits to excavate in the public right-of-way.

"6. The permittee shall replace, or cause to be replaced, existing traffic striping and markings damaged as a result of the work.

"(b) Sidewalk, curb and driveway restoration.

"1. The permittee shall replace, or cause to be replaced, from joint to joint, all concrete sidewalk and curb sections that are disturbed, disrupted or damaged as a result of the permitted work.

"2. The permittee shall bore, or cause to be bored, all driveways where possible. The city engineer, or his or her designee, may grant a variance from this requirement on a case-by-case basis to account for unusual site conditions. Driveways that are allowed to be open cut shall be saw cut to form straight lines across the driveway. The city engineer, or his or her designee, may require that the entire driveway be replaced if it is determined to be in the best interest of the city to do so.

"3. The permittee shall make, or cause to be made, all concrete repairs in accordance with the city of Birmingham's standard specifications and details. Said specifications and details are on file in the office of the city engineer.

"4. If the permittee fails to replace, or fails to cause to be replaced, as directed by the city engineer or his designee, any sidewalk, curbs or driveways that are disturbed, disrupted or damaged as a result of the permitted work, the bond shall be forfeited and the permittee will not be issued any subsequent permits to excavate in the public right-of-way.

"Sec. 4-5-145 Appealing decisions of the City Engineer.

"Any discretionary decision of the city engineer, or his or her designee, referenced in Sec. 4-5-144 which results in loss of property interests or costs other than set fees may be appealed to the city council for a public hearing on the matter. Person or permittee shall be required to provide written notice to the city engineer and the city clerk to request such hearing within fourteen (14) days of receipt of written notice of decision or the challenge to such decision or cost is waived. Upon a filing of a timely written Notice of Appeal hereunder filed in the Office of the City Clerk, a public hearing on the matter before the city council will be held within thirty (30) days of the filing of the Notice of Appeal."

Section 2. All ordinances or parts of ordinances heretofore adopted by the Council of the City of Birmingham which are inconsistent with the provisions of this ordinance are hereby repealed.

Section 3. If any section, sentence, clause or phrase of this ordinance is for any reason held to be invalid or unconstitutional by declaration of a court of competent jurisdiction, such declarations shall not affect the validity of remaining portions of this ordinance.

Section 4. This ordinance shall be in full force and effect upon its adoption and publication as required by law.

Adopted by the Council of the City of Birmingham August 31, 2010 and Approved by the Mayor September 3, 2010

Paula B. Smith
City Clerk

Pavement Repair – General Notes

1. The Permittee shall notify the Engineer at least 24 hours prior to beginning work.
2. The Permittee shall perform all work in accordance with the City of Birmingham's standard specifications and details.
3. Existing pavements, bases, curbs & gutters, etc., shall be cut to from neat and straight lines making squares or rectangular shapes as directed by the Engineer.
4. The Engineer shall determine the limits or extent of the permanent repair.
5. Backfill material shall be either ALDOT #57 stone placed in approximate 12 inch lifts or flowable fill with a maximum compressive strength of 100 psi.
6. No excavated material shall be used as backfill.
7. The Engineer may approve the use of alternative crushed stone materials as backfill subject to the Permittee complying with the following:

   Backfill material shall be compacted in lifts not exceeding 6 inches to 100% of the Standard Proctor maximum dry density.

   The Permittee shall provide Proctor values for the backfill material to be used, compaction test reports and a ceritfication from licensed geotechnical engineer, approved by the Engineer, stating that the backfill material has been compacted to the required density for the full depth of the excavation.

   The Permittee shall bear all costs associated with testing.
8. No excavated material shall be used as backfill.
9. The repaired area shall be allowed to stabilized for 30 days before the permanent repair is made.
10. The cold mix asphalt temporary repair shall be removed prior to making the permanent repair.
11. The Permittee shall be responsible for repairing any defects, including settlement, in the completed repair for a period of one year from the date of completion of the permanent repair.
12. The Permittee shall restore, as directed by the Engineer, any pavement markings, lane striping or traffic loops damaged as a result of the Permittee's work.

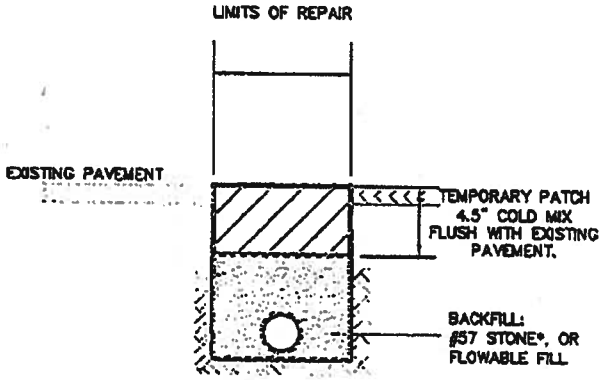
SHEET 1 OF 1

Approved by: [signature] City Engineer Date: 10/13/10	PAVEMENT REPAIR - GENERAL NOTES CITY OF BIRMINGHAM DEPARTMENT OF PLANNING, ENGINEERING & PERMITS ENGINEERING DIVISION		Drawing No.

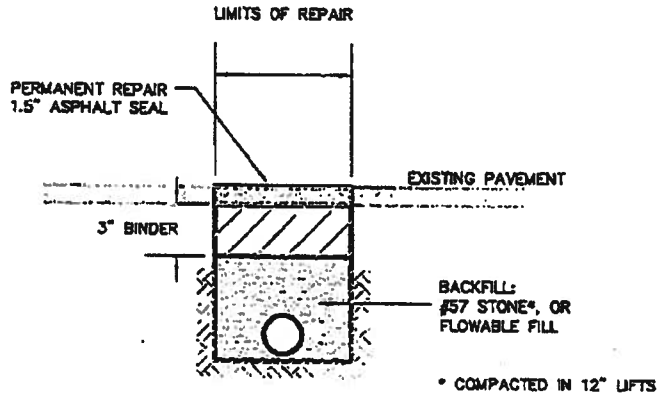
ALABAMA REGISTERED No. 16185 PROFESSIONAL ENGINEER RANDALL E. KEITH

NOTES:

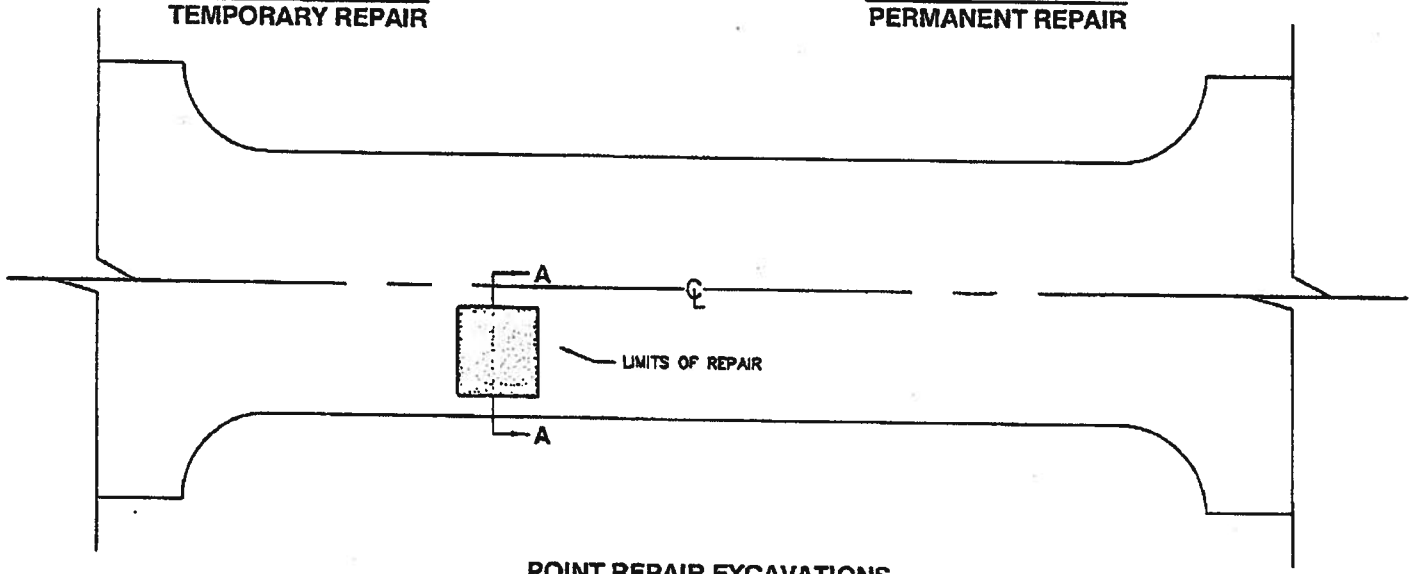
1. SEE "PAVEMENT REPAIR – GENERAL NOTES" SHEET.



SECTION A-A
TEMPORARY REPAIR



SECTION A-A
PERMANENT REPAIR



POINT REPAIR EXCAVATIONS
NOT TO SCALE

SHEET 1 OF 1

Drawing No.

PAVEMENT REPAIR DETAIL A

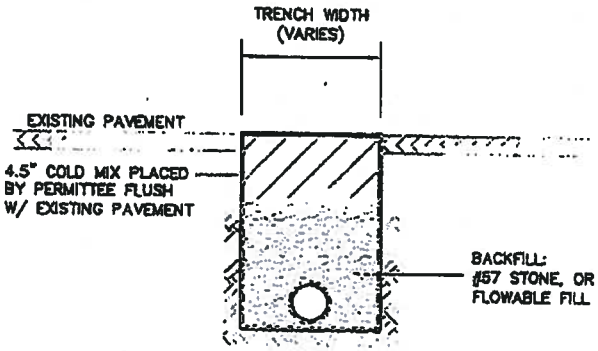
CITY OF BIRMINGHAM
DEPARTMENT OF PLANNING, ENGINEERING & PERMITS
ENGINEERING DIVISION

Approved by:
City Engineer

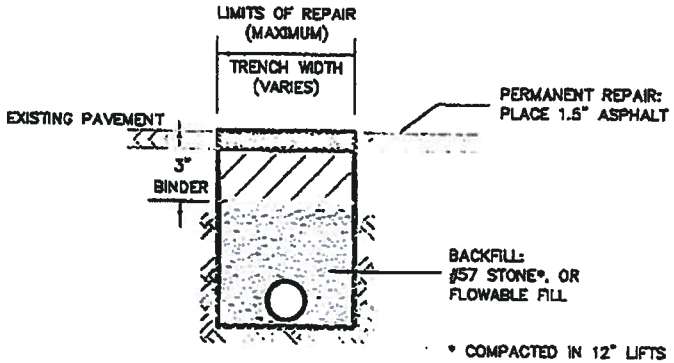
Date: 10/12/10

NOTES:

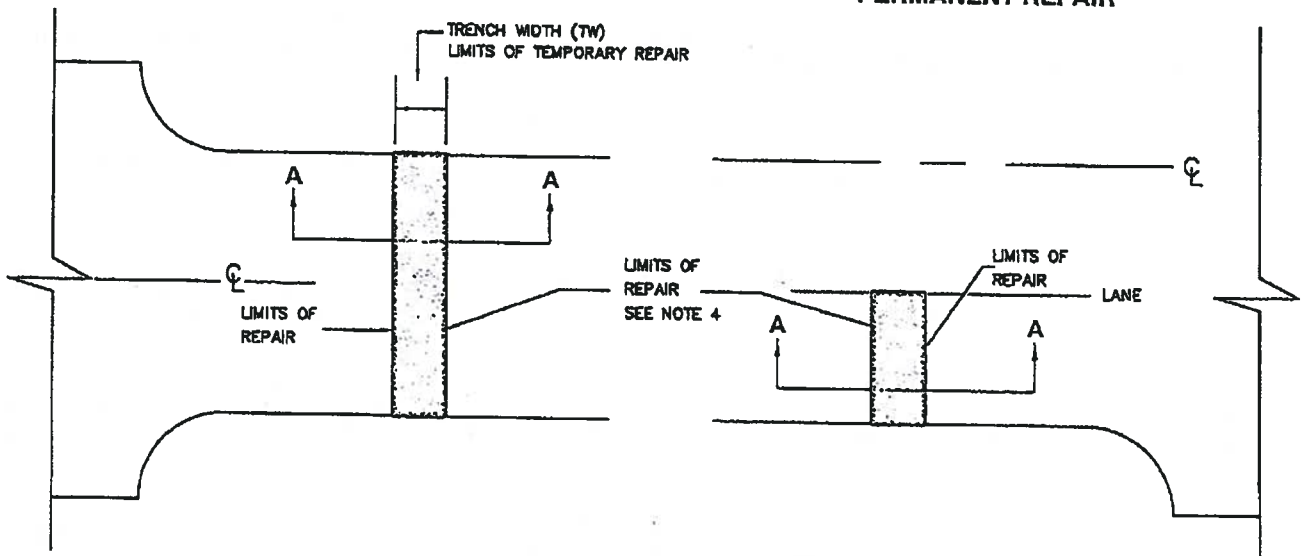
1. SEE "PAVEMENT REPAIR -- GENERAL NOTES" SHEET.



SECTION A-A
TEMPORARY REPAIR



SECTION A-A
PERMANENT REPAIR



TRANSVERSE EXCAVATIONS

NOT TO SCALE

SHEET 1 OF 1

Drawing No.

PAVEMENT REPAIR DETAIL B

CITY OF BIRMINGHAM
DEPARTMENT OF PLANNING, ENGINEERING & PERMITS
ENGINEERING DIVISION

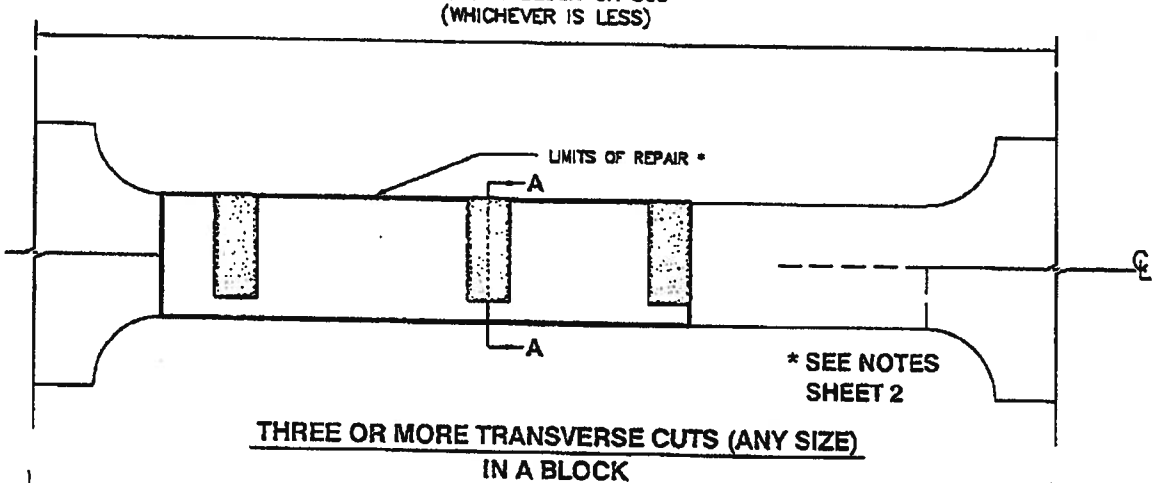
Approved by: _____
City Engineer

Date: 6/12/10

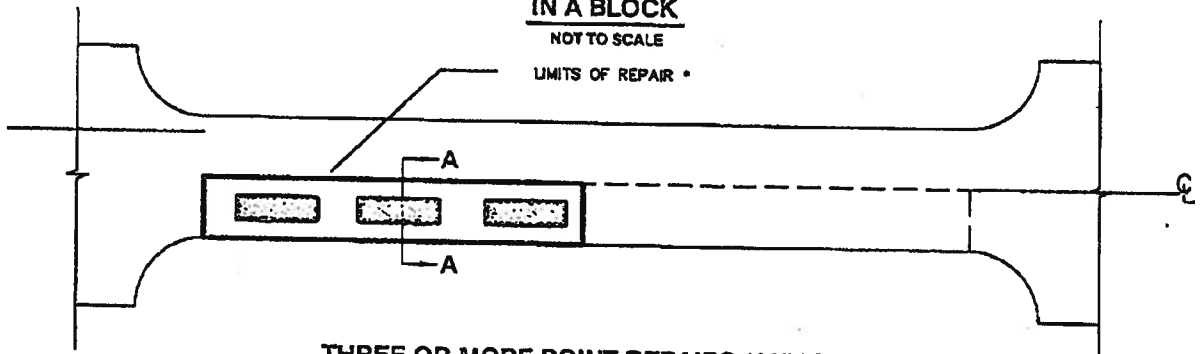
NOTES:

1. SEE " PAVEMENT REPAIR – GENERAL NOTES" SHEET.

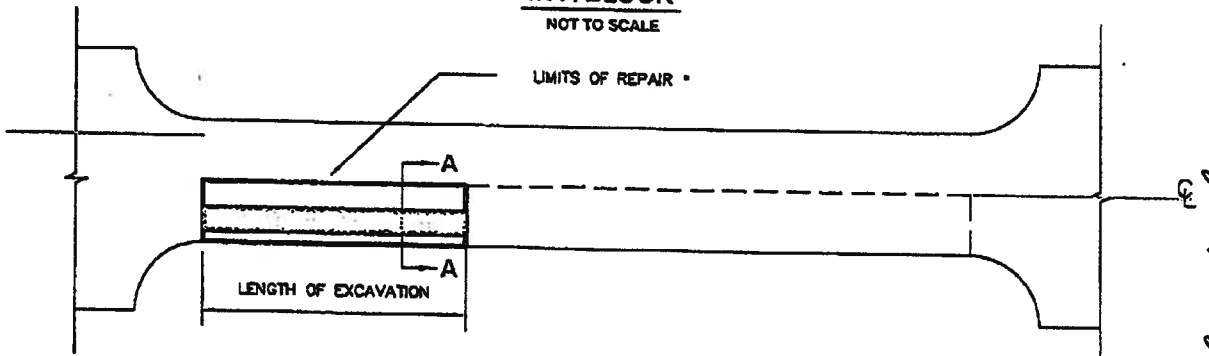
2. PERMITTEE SHALL NOT BE RESPONSIBLE FOR CUTS MADE BY OTHERS. HOWEVER, IF A PERMITTEE MAKES THREE OR MORE CUTS IN A STREET, REGARDLESS OF THE AMOUNT OF TIME THAT MAY ELAPSE BETWEEN CUTS, THE STREET SHALL BE REPAIRED IN ACCORDANCE WITH THIS DETAIL.



THREE OR MORE TRANSVERSE CUTS (ANY SIZE)
IN A BLOCK
NOT TO SCALE



THREE OR MORE POINT REPAIRS (ANY SIZE)
IN A BLOCK
NOT TO SCALE



LONGITUDINAL EXCAVATIONS
NOT TO SCALE

Drawing No.

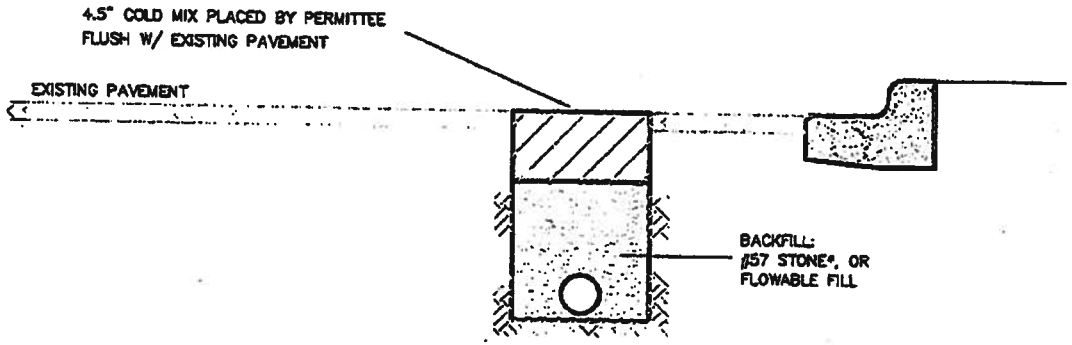
PAVEMENT REPAIR DETAIL C

CITY OF BIRMINGHAM
DEPARTMENT OF PLANNING, ENGINEERING & PERMITS
ENGINEERING DIVISION

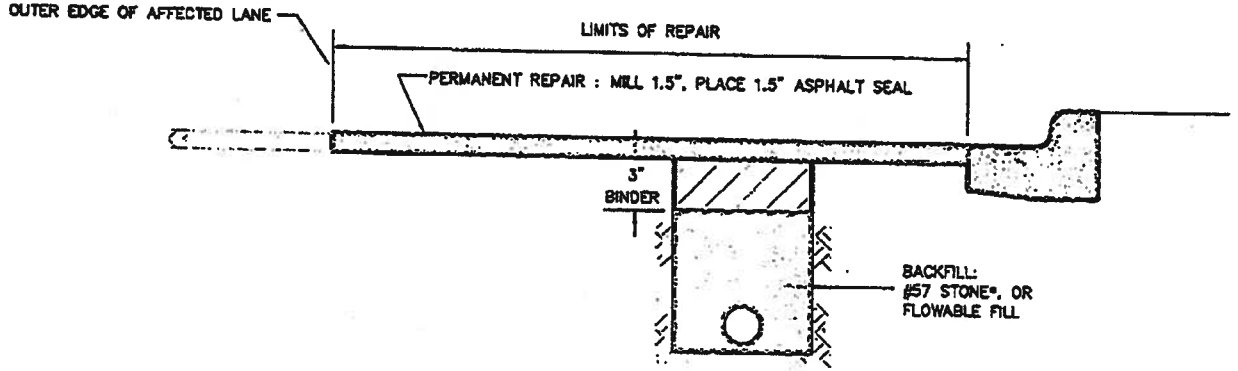
Approved by: [signature]
City Engineer
Date: 10/12/10

SHEET 1 OF 2

SEE NOTES ON SHEET 1



SECTION A-A
TEMPORARY REPAIR
NOT TO SCALE



SECTION A-A
PERMANENT REPAIR
NOT TO SCALE

SHEET 2 OF 2

Drawing No.

PAVEMENT REPAIR DETAIL C

CITY OF BIRMINGHAM
DEPARTMENT OF PLANNING, ENGINEERING & PERMITS
ENGINEERING DIVISION

Approved by: City Engineer

Date: 10/12/10

ALABAMA REGISTERED No. 18185 PROFESSIONAL ENGINEER RANDALL T.

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APPENDIX G
LIST OF RIGHT-OF-WAY PROMISES

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JEFFERSON COUNTY COMMISSION

JAMES A. (JIMMIE) STEPHENS - PRESIDENT
LASHUNDA SCALES - PRESIDENT PRO TEMPORE
SHEILA TYSON
STEVE AMMONS
JOE KNIGHT

TONY PETELOS
CHIEF EXECUTIVE OFFICER

DAVID DENARD
Director of Environmental Services Department
SUITE A300
716 Richard Arrington, Jr. Blvd. N.
Birmingham, Alabama 35203
Telephone (205) 325-5496
Fax (205) 325-5981

MEMORANDUM

TO: David Denard
Director of Environmental Services Department

FROM: James F. Henderson, Jr., County Property Manager
Right of Way Division – Roads and Transportation Department

RE: **2019 Pump Station Upgrades No. 1**

DATE: November 16, 2020

The right of way acquisition for the above-referenced project has been completed. During the negotiation, certain special promises/agreements were made and should be fulfilled during the construction of said project.

Restoration
On all tracts in this project acquired by the Jefferson County Right of Way, each property owner has been promised that the contractor shall clean up the work area, and re-grade and re-grass "in kind" all disturbed areas but is limited to only the areas involved in the easements acquired.

The List of Promises specific to each tract for this project are found below:

Tract 1 **Jefferson County Board of Education**

1. Contractor shall repair any damage to the driveway surface located between the intersection of Eastern Valley Road and the intersection with the pump station driveway, caused during the construction of said project.

Tract 2 **Tannehill Christian Life Church, Inc.**

No additional promises.

Tract 3 **Jefferson County Economic and Industrial Development Authority, an Alabama Public Corporation**

No additional promises.

Tract 4 **Stuart Lee Norton**

No additional promises.

Tract 5 **Shannon & Pamela Hollon**

1. Contractor shall re-grade and re-grass "in kind" all disturbed areas.
2. Contractor shall repair any damage to the driveway located in the Temporary Construction Easement that is caused from the construction of this project.
3. Contractor shall remove from the property any debris and excess materials that stem from the construction of the project.
4. Contractor agrees to stay outside the drip line of the one oak tree located in the middle of the front yard that is next to the Temporary Construction Easement.
5. Contractor shall not disturb the landscaping and/or plants located within the Temporary Construction Easement at the Southwest corner of the property, any plants damaged within this area, due to the construction, will be replaced with like kind of similar value, as approved by the owner.
6. Contractor agrees to regrade the hill located at the front of the Temporary Construction easement to a gradual slope.
7. Contractor agrees to repair the cut made to the driveway to its like condition.

Tract 6 **Jacky & Kim Shubert**

1. Contractor shall re-grade and re-grass "in kind" all disturbed areas.
2. Contractor shall repair any damage to the driveway located in the Temporary Construction Easement that is caused from the construction of this project.
3. Contractor shall remove from the property any debris and excess materials that stem from the construction of the project.

Tract 7 **Sakeith C. Holland & Jamarious H. Crusoe**

1. Contractor shall re-grade and re-grass "in kind" all disturbed areas.
2. Contractor shall repair any damage to the driveway located in the Temporary Construction Easement that is caused from the construction of this project.
3. Contractor shall remove from the property any debris and excess materials that stem from the construction of the project.
4. The contractor shall provide Ingress & Egress access to the property at all times during construction.
5. Contractor is not to disturb the landscaping within the Temporary Construction Easement located on the southwest side of the driveway, any landscaping disturbed within this area, due to the construction, will be put back to its like condition by the Contractor.

Should you have any questions concerning these promises please call **Hubert Chapman**, Senior Land Acquisition Agent, at **(205) 325-4837**.

JFH/hc
cc: Brian Rohling
file

County Division Code: AL040
Inst. # 2020008671 Pages: 1 of 4
I certify this instrument filed on
1/27/2020 10:47 AM Doc: D
Alan L.King, Judge of Probate
Jefferson County, AL.

Clerk: MORRISL

THIS INSTRUMENT WAS PREPARED BY:
Hubert Chapman
Roads & Transportation – Jefferson County
Room A-200 Courthouse
716 Richard Arrington, Jr. Blvd. N.
Birmingham, AL 35203

SEND TAX NOTICE
Jefferson County Alabama
C/O Right of Way A-200
716 Richard Arrington Jr. Blvd N
Birmingham, AL 35203

STATE OF ALABAMA)
JEFFERSON COUNTY)

STATUTORY WARRANTY DEED

KNOW ALL MEN BY THESE PRESENTS, that for and in consideration of ONE DOLLAR ($1.00) and other good and valuable consideration to the **JEFFERSON COUNTY BOARD OF EDUCATION,** an instrumentality of the State of Alabama (hereinafter referred to as "Grantor"), in hand paid by **JEFFERSON COUNTY, ALABAMA,** a political subdivision of the State of Alabama (hereinafter referred to as "Grantee") the receipt of which whereof is acknowledged, the Grantor does hereby grant, bargain, sell, and convey unto the Grantee the following two parcels of land situated in Jefferson County, Alabama, that are particularly described as follows (the "Property"):

Parcel 1

Commence at a 3" pipe located at the Northeast corner of the Northeast ¼ of Section 22, Township 20 South, Range 5 West; thence run west along the north boundary line of said section for a distance of 2224.30 feet; thence turn an angle left 90°0′0″ and run southerly for a distance of 477.67 feet to a southeasterly property line of the Grantor and the **Point of Beginning** of said parcel; thence turn an angle right 55°45′19″ and run southwesterly for a distance of 199.89 feet, being **Point A** for future reference; thence turn an angle right 175°47′22″ and run northeasterly for a distance of 110.46 feet; thence turn an angle left 66°09′24″ and run northwesterly for a distance of 52.49 feet; thence turn an angle right 90°0′0″ and run northeasterly for a distance of 59.17 feet; thence turn an angle right 46°53′47″ and run southeasterly for a distance of 41.07 feet to the Point of Beginning.

Parcel 2

Commence at **Point A**, as described above in parcel 1; thence turn an angle left 90°16′45″ and run southeasterly for a distance of 24.99 feet to the **Point of Beginning** of said parcel; thence continue southeasterly for a distance of 50.12 feet; thence turn an angle right 86°05′11″ and run southwesterly for a distance of 185.44 feet; thence turn an angle right 89°58′27″ and run northwesterly for a distance of 33.24 feet to the point of beginning of a curve to the right having a radius of 31.50 feet, a chord direction of N 22°05′32″ W, and an arc length of 17.67 feet, thence run northwest along the arc of said curve for a distance of 17.67 feet to the end of said curve; thence turn an angle to the right 73°57′05″ and run northeasterly for a distance of 184.05 feet to the Point of Beginning.

All of said Parcel 1 and Parcel 2 are located in the NW ¼ of the NE ¼ of Section 22, Township 20 South, Range 5 West. Parcel 1 contains 0.09 acres more or less, and Parcel 2 contains 0.21 acres more or less. A map depicting the location of these two Parcels is attached as **Exhibit B** and incorporated by reference.

TOGETHER WITH all and singular the tenements, hereditaments and appurtenances thereunto belonging or in any wise appertaining to the Property unto the Grantee, and its successors and assigns, forever, in fee simple, free and clear of liens and encumbrances, unless otherwise set forth herein on **Exhibit A** attached hereto and incorporated herein by reference (the "Permitted Encumbrances").

TO HAVE AND TO HOLD unto said Grantee, its successors and assigns forever.

Grantor covenants that it is seized in fee-simple of said Property and has a good right to sell and convey the same and shall warrant and defend the Property to the Grantee (and its successor and assigns) forever against the lawful claims of all persons claiming by, through or under the Grantor, except for the Permitted Exceptions against which Grantor shall not defend. Except for these express warranties, Grantor makes no warranty or covenant respecting the nature or quality of the title to the Property hereby conveyed, its condition (which is accepted by Grantee AS IS, WHERE IS) or whether it is fit for the uses or purposes intended by Grantee.

IN WITNESS WHEREOF, the Grantor has hereunto set its hand and seal as of the 23rd day of January, 2020.

JEFFERSON COUNTY BOARD OF EDUCATION

By: _____
Ronnie Dixon

Its: President

STATE OF ALABAMA)
JEFFERSON COUNTY)

I, the undersigned, a Notary Public in and for the said State and County, hereby certify that Ronnie Dixon, whose name as President of the Jefferson County Board of Education is signed to the foregoing instrument, and who is known to me, acknowledged before me on this day that, being informed of the contents of it, he, as such officer, and with full authority, has executed the same voluntarily for and as the act of said entity.

Given under my hand this 23 day of January, 2020.

[NOTARIAL SEAL]

Barbara Ann Littles
Notary Public

My Commission Expires _____

Barbara Ann Littles
NOTARY PUBLIC
ALABAMA STATE AT LARGE
My Commission Expires
March 7, 2022

EXHIBIT A - PERMITTED EXCEPTIONS

1. Mineral and mining rights of whatever kind and subsurface and surface substances, (including, without limitation, coal, ignite, oil, gas, clay, rock, sand and gravel) in, on or under said Property and that may be produced from it, together with all rights, privileges and immunities related thereto.

2. Any applicable zoning ordinances or regulations.

3. Any unfiled mechanics' and materialman's' liens, governmental assessments and any other unrecorded liens.

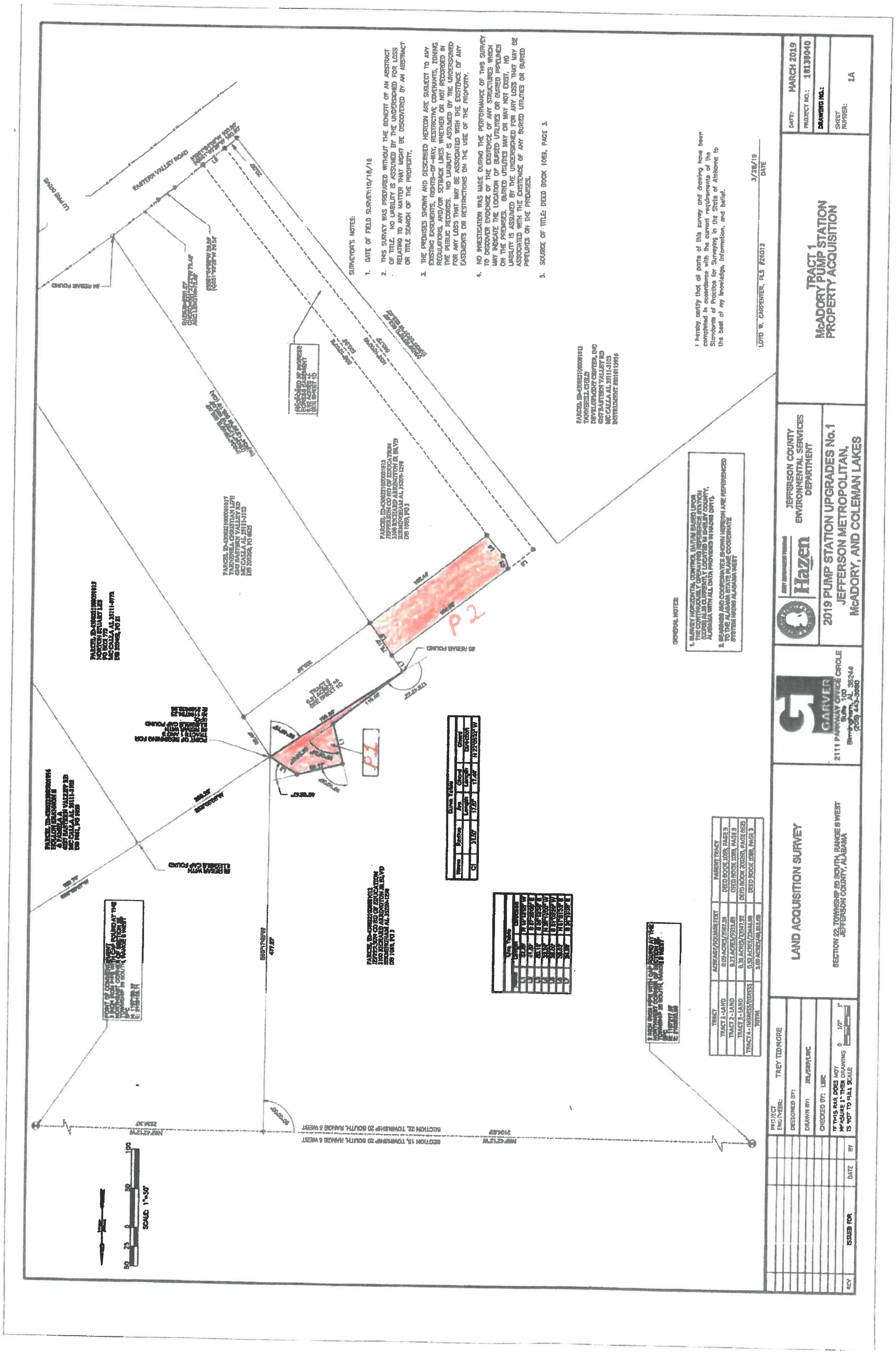
4. Any encroachment, encumbrance violation, variation or adverse circumstances affecting the Property would or may have been disclosed or indicated by a land survey of the Property.

5. Any easements, restrictions and rights of way of record.

6. Easement granted to Alabama Power Company by instrument recorded in the Probate Office of Jefferson County in Book LR201418, Page 25338

7. Rights of way granted to Jefferson County in the following instruments recorded in the Probate Office of Jefferson County: Book 9862, Page 7718; Book 200161, Page 6012; and Book LR 200663, Page 18819.

EXHIBIT B



LAND ACQUISITION SURVEY
TRACT 1
McADORY PUMP STATION
PROPERTY ACQUISITION
JEFFERSON COUNTY
ENVIRONMENTAL SERVICES
DEPARTMENT
Hazen
2019 PUMP STATION UPGRADES No.1
JEFFERSON METROPOLITAN,
McADORY, AND COLEMAN LAKES
MARCH 2019
18138040
1A
P2
P1

County Division Code: AL040
Inst. # 2020018664 Pages: 1 of 3
I certify this instrument filed on
2/24/2020 10:33 AM Doc: D
Alan L.King, Judge of Probate
Jefferson County, AL.

Clerk: SANDERSL

THIS INSTRUMENT PREPARED BY:
Hubert J. Chapman, Land Acquisition Agent
Roads & Transportation
Room A-200 Courthouse
716 Richard Arrington, Jr. Blvd. N.
Birmingham, AL 35203

STATE OF ALABAMA)
JEFFERSON COUNTY)

EGRESS AND INGRESS EASEMENT
(Use Segment of Drive between Eastern Valley Rd. & McAdory Elementary Sch.)

KNOW ALL MEN BY THESE PRESENTS, that for and in consideration of ONE DOLLAR ($1.00) and other good and valuable consideration to the JEFFERSON COUNTY BOARD OF EDUCATION, an instrumentality of the State of Alabama (hereinafter referred to as "Grantor"), in hand paid by JEFFERSON COUNTY, ALABAMA, a political subdivision of the State of Alabama (hereinafter referred to as "Grantee") the receipt of which whereof is acknowledged, does hereby grant and convey unto the Grantee to the extent of its ownership and upon the terms, conditions, and limitations hereinafter set forth, a perpetual, non-exclusive egress and ingress easement (hereinafter the "Easement") with respect to the following described area (the "Easement Area"):

Commence at a 3" pipe located at the Northeast corner of the Northeast ¼ of Section 22, Township 20 South, Range 5 West; thence run west along the north boundary line of said section for a distance of 2224.30 feet; thence turn an angle left 90°0′0″ and run southerly for a distance of 477.67 feet to a southeasterly property line of the Grantor; thence turn an angle right 55°45′19″ and run southwesterly for a distance of 199.89 feet; thence turn an angle left 90°16′45″ and run southeasterly for a distance of 24.99 feet; thence turn an angle right 86°05′11″ and run southwesterly for a distance of 184.05 feet to the Point of Beginning of said ingress/egress easement; thence continue southwesterly for a distance of 39.83 feet; thence turn an angle left 90°01′33″ and run southeasterly for a distance of 640.73 feet; thence turn an angle left 90°46′31″ and run northeasterly for a distance of 35 feet; thence turn an angle left 89°13′29″ and run northwesterly for a distance of 623.58 feet to the point of beginning of a curve to the right having a radius of 31.50 feet, a chord direction of S 22°05′32″ E, a chord length of 17.44 feet, and an arc length of 17.67 feet; thence run northwesterly along the arc of said curve for a distance of 17.67 feet to the end of said curve and to the Point of Beginning.

All of said Easement Area, which contains 0.52 acres more or less, is a segment of the access drive lying between Eastern Valley Road and McAdory Elementary School and is delineated on the attached Map incorporated herein as **Exhibit A**, is located in the NW ¼ of the NE ¼ of Section 22, Township 20 South, Range 5 West.

Grantee covenants and agrees that (a) its use of the Easement Area is strictly limited to purposes related to the construction, installation or maintenance of sanitary sewer facilities that have been or will be placed on land near that Area (the "Permitted Use"); (b) it, at its expense, will repair any damage to, on, or along the Easement Area resulting from the operation of vehicles, transport of equipment or otherwise occurring from its use of the Easement Area; (c) to the extent allowed by Alabama Law, Grantor shall not be responsible or liable for damage whatsoever to persons or property that may result from Grantee's use of the Easement Area and/or defects (latent or patent) or alleged unsafe conditions concerning the land upon which said Easement is herein granted; and (d) to the extent allowed by Alabama law, Grantee assumes all risk of personal injury and death of its employees, and/or property damage of the Grantee and its employees from Grantee's use of said Easement. These covenants shall run with the land as against Grantee and all its successors in title. **Grantor warrants that it has the right to grant the Easement. Except for this express warranty, Grantor makes no warranty or covenant respecting the nature or quality of its title to the Easement Area, the condition of that Area (which is accepted by Grantee AS IS, WHERE IS) or whether that Area is fit for the uses or purposes intended by Grantee.**

TO HAVE AND TO HOLD unto the Grantee, its successors or assigns, forever, SUBJECT, however to the following: (a) such easements as may exist over, under, upon, along, or across said Easement Area for railroads, electric power transmission lines, telephone lines, telegraph lines, pipelines, and public or private roads; and (b) all matters of record affecting or related to the Easement Area.

IN WITNESS WHEREOF, the Grantor has hereunto set its hand and seal as of the 23rd day of January, 2020

JEFFERSON COUNTY BOARD OF EDUCATION

By: _____
Ronnie Dixon

Its: President

STATE OF ALABAMA)
JEFFERSON COUNTY)

I, the undersigned, a Notary Public in and for the said State and County, hereby certify that Ronnie Dixon, whose name as President of the Jefferson County Board of Education is signed to the foregoing instrument, and who is known to me, acknowledged before me on this day that, being informed of the contents of it, he, as such officer, and with full authority, has executed the same voluntarily for and as the act of said entity.

Given under my hand this 23 day of January, 2020

[NOTARIAL SEAL]

Barbara Ann Littles
Notary Public

My Commission Expires: Barbara Ann Littles NOTARY PUBLIC ALABAMA STATE AT LARGE My Commission Expires March 7, 2022

IN WITNESS WHEREOF, the undersigned have hereunto set their hands and seals, all on this 20th day of February, 2020

ATTEST:

Mildred G. DiLiberto
Minute Clerk

JEFFERSON COUNTY, ALABAMA

James A Stephens, President
Jefferson County Commission

STATE OF ALABAMA)

JEFFERSON COUNTY)

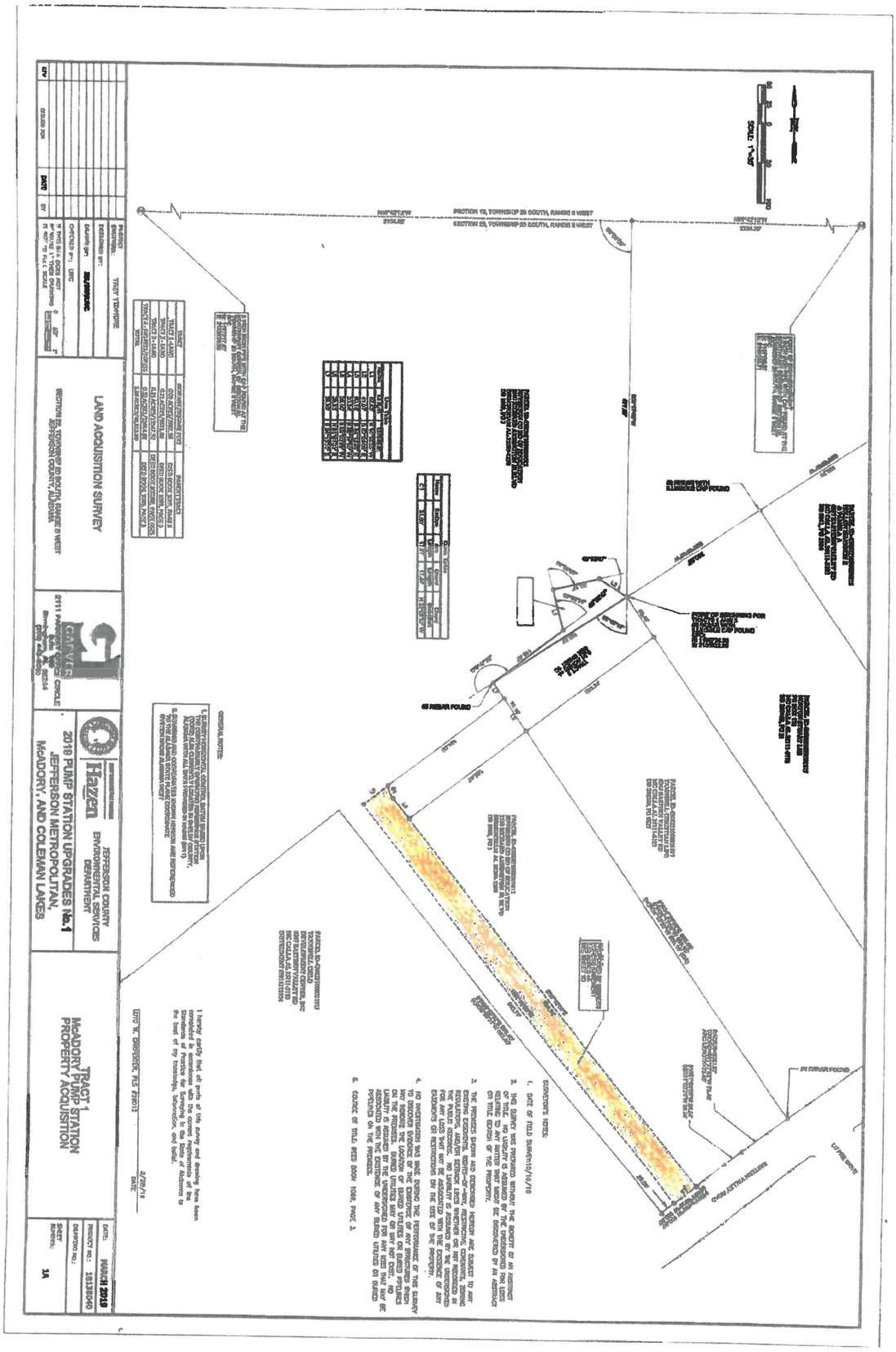
I, Mildred G. DiLiberto a Notary Public in said County and State, hereby certify that **James A Stephens** whose name as **President of the Jefferson County Commission** is signed to the foregoing conveyance, and who is known to me, acknowledged before me on this day that, being informed of the contents of the conveyance, he, as such officer, and with full authority, executed the same voluntarily for and as the act of said commission.

Given under my hand and official seal, this 20th day of February, 2020

Mildred G. DiLiberto
Notary Public

My Commission expires: August 23, 2023

EXHIBIT A – MAP DELINEATING EASEMENT AREA



This instrument prepared by
Hubert Chapman, Land Acquisition Agent
Courthouse, Ste. A-200
716 Richard Arrington Jr., Blvd. North
Birmingham, AL 35203

STATE OF ALABAMA)

JEFFERSON COUNTY)

KNOW ALL MEN BY THESE PRESENTS: That for and in consideration of the sum of One and no/100s Dollars ($1.00) cash in hand paid by Jefferson County, the receipt whereof is hereby acknowledged, we the undersigned, do hereby grant, bargain, sell and convey unto the said Jefferson County, Alabama, its successors and assigns, a temporary construction easement for sanitary sewer purposes, including the installation and maintenance of sewer pipelines, underground and on the surface, and underground and surface support facilities, including stations, access points, stubouts and manholes, said temporary construction easement being located in Jefferson County, Alabama and described as follows, to-wit:

A Temporary Construction Easement more particularly described as follows:

Commence at a 3" pipe located at the Southeast corner of the Southeast ¼ of section 15, Township 20 South, Range 5 West; thence run west along the south boundary line of said section for a distance of 2514.23 feet; thence turn an angle right 90°0′0″ and run north for a distance of 2254.17 feet to the **Point of Beginning** of said Temporary Construction Easement; thence turn an angle left 78°03′31″ and run northwesterly for a distance of 75.20 feet; thence turn an angle right 90°01′38″ and run northeasterly for a distance of 130 feet; thence turn an angle right 89°58′22″ and run southeasterly for a distance of 97.65 feet; thence turn an angle right 90°0′0″ and run southwesterly for a distance of 30 feet; thence turn an angle right 90°01′38″ and run northwesterly for a distance of 58.26 feet; thence turn an angle left 0°11′45″ and run northwesterly for a distance of 9.40 feet; thence turn an angle left 89°48′15″ and run southwesterly for a distance of 70 feet; thence turn an angle left 90°01′38″ and run southeasterly for a distance of 45.19 feet; thence turn an angle right 90°0′0″ and run southwesterly for a distance of 30 feet to the point of beginning.

All of said Temporary Construction Easement is located in the NW ¼ of the SE ¼ of Section 15, Township 20 South, Range 5 West, and contains 0.17 acres more or less.

The Temporary Construction Easement will terminate upon the completion and acceptance of said project and thereafter will constitute no cloud on the title of the Grantor.

For the consideration aforesaid, the undersigned do grant bargain sell and convey unto the said County the right and privilege of a perpetual use of said lands for such public purpose, together with all rights and privileges necessary or convenient for the full use and enjoyment thereof, including the right of ingress to and egress from said strip and the right to cut and keep clear all trees, undergrowth and other obstructions on the lands of the undersigned adjacent to said strip when deemed reasonably necessary for the avoidance of danger in and about said public use of said strip, and the right to prohibit the construction or Maintenance of any improvement or obstruction (except fencing) or the placement of spoil or fill dirt and/or heavy equipment over or on top of the easement/right-of-way without the written permission of the Jefferson County Commission or its authorized agent.

In consideration of the benefit to the property of the undersigned by reason of the construction of said sewer facility, the undersigned hereby release Jefferson County, the State of Alabama, and/or the United States of America, and/or any of their agents, from all damages present or prospective to the property of the undersigned arising or resulting from the construction, maintenance and repair of said improvement, and the undersigned do hereby admit and acknowledge that said sewer facility, if and when constructed, will be a benefit to the property of the undersigned.

The undersigned covenant with said Jefferson County that the undersigned are seized in fee-simple of said premises and have a good right to sell and convey the same and that the same are free from all encumbrances, and the undersigned will warrant and defend the title to the aforegranted strip of ground from and against the lawful claims of all persons whomsoever.

IN WITNESS WHEREOF, the undersigned have hereunto set their hands and seals, all on this 17 day of MARCH 2019.

Jefferson County Economic and Industrial Development Authority, an Alabama public corporation

BY: _____
Theodore J. vonCannon

ITS: Executive Director

STATE OF ALABAMA)

JEFFERSON COUNTY)

I, THE UNDERSIGNED AUTHORITY, in and for said County, in said State, hereby certify that Theodore J. vonCannon whose name as Executive Director of **Jefferson County Economic and Industrial Development Authority**, an Alabama public corporation, is signed to the foregoing conveyance, and who is known to me, acknowledged before me on this day that, being informed of the contents of the conveyance, (he/she), as such officer, and with full authority, has executed the same voluntarily for and as the act of said corporation.

Given under my hand and official seal, this 17 day of May, 2019.

My commission expires _____

Donna M. DeLoach
Notary Public, Alabama State At Large
My Commission Expires February 17, 2020

Donna M. DeLoach
Notary Public

NOTARY PUBLIC

RESOLUTION

BE IT RESOLVED BY THE JEFFERSON COUNTY COMMISSION that upon the recommendation of the Director of Roads and Transportation and the Director of Environmental Services, the President of the Commission is hereby authorized to execute the attached Right of Entry Agreement between Alabama Power Company and Jefferson County, Alabama, hereto giving Jefferson County, Alabama, and/or its contractors, agents or assigns, permission to access the Alabama Power Easement located on Tract 3, 2019 Pump Station Upgrades No. 1, Jefferson Metropolitan, McAdory, and Coleman Lakes. This Right of Entry Agreement permits Jefferson County, Alabama, and/or its contractors, agents, or assigns use of the Alabama Power Easement as a Temporary Construction Easement for the purpose of making upgrades to the Jefferson Metropolitan Industrial Park Sewage Pump Station.

STATE OF ALABAMA)

JEFFERSON COUNTY)

I, Mildred G Diliberto, Minute Clerk of the Jefferson County Commission, hereby certify that the above and foregoing is a true and correct copy and/or transcript of a resolution duly adopted and approved by the Jefferson County Commission at its regular meeting held on the 5th day of March, 2020, as same appears and is recorded in Minute Book 174, Page(s) 154 of the Official Minutes and Records of said County Commission.

GIVEN, under my hand and seal of Jefferson County, Alabama this the 5th day of March, 2020.

Mildred G. Diliberto
Minute Clerk
Jefferson County Commission
My Commission Expires: August 23, 2023

TAW - Construction

SUBJECT:
1220AG BUCKSVILLE TAP

This Instrument Prepared By:
Luke Brown
Alabama Power Company
Post Office Box 2641
Birmingham, AL 35291

STATE OF ALABAMA)
:
COUNTY OF JEFFERSON)

THIS AGREEMENT, made and entered into on this the 14th day of February, 20 20, by and between **ALABAMA POWER COMPANY**, a corporation, (hereinafter referred to as **"Licensor"**), and **JEFFERSON COUNTY, ALABAMA,** (hereinafter referred to as **"Licensee"**)

W I T N E S S E T H:

WHEREAS, the said Licensor is the owner of an electric transmission line easement upon, over, and under certain lands located in the NW1/4 of the SE1/4 of Section 15, Township 20 S, Range 5 West, Jefferson County, Alabama, such easement being more particularly described in that certain instrument executed by Sam C. Rosser and wife, Eloise W. Rosser, dated April 14, 1998, recorded in 9805/8309 in the Office of the Judge of Probate, Jefferson County, Alabama. Reference is hereby expressly made to such records for a particular description of such easement or right-of-way; and

WHEREAS, the Licensee desires to use portions of said easement for the purpose hereinafter set out upon, under, through, along and across Licensor's easement and underneath the electric transmission line(s) located thereon; and

WHEREAS, Licensor is willing to grant, to the extent of its interest, such license of use for facilities of licensee upon, under, along, through and across such transmission line easement hereinabove described upon the terms and conditions hereinafter set out:

NOW, THEREFORE:

In consideration of the premises and the further consideration of the sum of One and No/l00 Dollar ($1.00), in hand paid to Licensor by the Licensee, receipt of which is hereby acknowledged, Licensor, to the extent of its interest, does hereby grant to the Licensee, its successors and assigns, subject to the terms and conditions hereinafter set forth, the right of entry upon, along, through and across its right of way and underneath the power transmission lines located thereon. The location of and specifications for the facilities of Licensee shall be as shown in red on Drawing TEMPORARY CONSTRUCTION EASEMENT ACQUISITION SURVEY, marked Exhibit "A", attached hereto and made a part hereof. The Licensee shall construct and maintain its facilities at the location hereinabove described in accordance with the following:

a. The said facilities of the Licensee shall be constructed and maintained in accordance with the adopted procedures of well-regulated businesses and undertakings of same or similar kind, and in such manner as not to cause the facilities of the Licensor to be in conflict with the specifications of the National Electrical Safety Code, or any other specifications prescribed by laws of the United States or of the State of Alabama, or any regulatory body having jurisdiction with respect to such facilities. At any time such specifications are not being met because of the construction, maintenance and/or presence of said facilities then the Licensee shall within 30 days after notice that such specifications are not being met, revise or alter said facilities of the Licensee in accordance with such specifications.

b. In the event said facilities of the Licensee interferes with the existing structures or facilities of Licensor which are located on or under such right of way including, but not limited to towers, poles, guy wires, conductors, crossarms, counterpoise, conductors or anchors, or in the event said facilities of the Licensee interferes with the construction, operation or maintenance of additional structures or facilities to be placed on or under such right of way, the Licensee shall revise or alter said facilities of the Licensee in such a manner so that it will not interfere with the construction, operation or maintenance of such existing or additional structures and facilities.

c. Licensor specifically reserves unto itself the right of ingress and egress to and from its facilities at all times and should said facilities of the Licensee so constructed hinder or interfere with Licensor's ingress and egress for the proper operation and maintenance of its facilities, then the Licensee shall make the necessary provisions to eliminate same.

d. The Licensee shall construct and maintain said facilities of the Licensee both now and in the future, in order to prevent any erosion or washing away of the lands of Licensor which

its facilities cross. If at any time said facilities of the Licensee is the underlying cause of any erosion or washing, then the Licensee will immediately take necessary steps to prevent same.

e. The Licensee shall do no blasting within fifty (50) feet of any tower foundation and in the event it becomes necessary in the construction and installation of said facilities of the Licensee to use dynamite or do any blasting outside the said fifty (50) foot radius of tower foundations, the Licensee shall use blasting mats in order to protect the facilities of Licensor.

f. The Licensee, in the construction and maintenance of said facilities of the Licensee shall not deposit or place any spoil closer than 25 feet of any Licensor's poles, towers, structures and/or guy wires presently located on said lands and no spoil shall be placed at any location that will reduce the present conductor clearances underneath Licensor's facilities.

g. The Licensee shall mark and keep marked, with permanent monuments extending two feet (2') above the earth, the point of entry, intervals every two hundred (200) feet, and exit of the line on said right of way of Licensor; however, neither Licensor nor its agents, servants or employees shall be liable for any loss, damage or claim resulting from and/or caused by contact with and/or pressure on said facilities of the Licensee unless the Licensee shall have so marked the route of said facilities of the Licensee on the right of way so as to indicate its courses therefor. No sign or structures shall be erected and maintained on said right of way above ground level by the Licensee except as provided for herein.

h. Upon completion of the construction, the Licensee shall remove or cause to be removed all equipment used and all debris and refuse resulting from the construction of said facilities and shall leave the premises in a condition satisfactory to Licensor.

i. The Licensee agrees to reimburse Licensor for damage to any of Licensor's facilities resulting from the construction, operation, maintenance, and repair and/or removal of said facilities of the Licensee.

j. The Licensee will at all times hereafter indemnify, protect and save harmless the Licensor from any and all claims, loss, damage, expense and liability which Licensor may incur, suffer, sustain, or be subjected to resulting from or arising out of the negligent use by Licensee of the rights herein granted. "Negligent use" as the term is used herein shall include any violation of the foregoing or the following provisions:

(1) The Licensee shall use extreme caution in operating machinery and equipment across said lands and shall at all times maintain at least a clearance between the machinery and the overhead conductors, as will meet the following standards:
   (i) for lines rated 50 kV or below, minimum clearance between the lines and any part of the equipment or load shall be 10 feet.
   (ii) for lines rated over 50 kV, minimum clearance between the lines and any part of the equipment or load shall be 10 feet plus 0.4 inch for each 1 kv over 50 kV, or twice the length of the line insulator, but never less than 10 feet.

(2) The Licensee shall also maintain a horizontal clearance adequate in distance for all purposes to protect Licensor's facilities between the machinery and any of Licensor's poles, towers, structures, counterpoise facilities and/or guy wires placed on such lands in the future.

(3) There shall be no physical contact with Licensor's support structures or the lessening of support therefor, or damage to any of Licensor's support structures, guys or counterpoise facilities therefor.

(4) Any metal pipeline being installed on Licensor's right of way shall be installed with the pipe constantly grounded so as to prevent all injuries as could arise from induced electric charges or shock during construction, maintenance, use or removal of the pipeline.

(5) Blasting on the right of way shall be conducted only in a completely safe manner so as to prevent all injury whatsoever to any person or property.

Any breach by the Licensee of said standards of care agreed to in writing and as set out above should be considered negligence per se on the part of the Licensee.

Licensee agrees to obtain all necessary rights from the owners of the lands crossed by Licensor's easement in the event Licensee does not own the lands and rights.

Provided further, for any construction, installation or other use of the rights herein granted to be performed for the Licensee by an individual or entity other than the Licensee (including the Licensee's contractors, agents or assigns), the Licensee's contractors, agents or assigns shall obtain and provide proof of acceptable liability insurance protection, prior to the start of construction, for Licensor as a named insured on a policy conforming to Exhibit "B" attached hereto.

Herein the term "the Licensee" shall include the named Licensee in this document and its employees.

This agreement shall inure to and be binding upon the successors and assigns of the parties hereto.

IN WITNESS WHEREOF, the undersigned have hereunto set their hands and seals, all on this 19th day of February, 2020

ATTEST:

Nelli DiBiase
Minute Clerk

JEFFERSON COUNTY, ALABAMA

James A Stephens, President
Jefferson County Commission

ALABAMA POWER COMPANY

By: _____

Name: John Chitwood

Title: Right of Way Services Supervisor

****

STATE OF ALABAMA)

JEFFERSON COUNTY)

I, _____, a Notary Public in said County and State, hereby certify that **James A Stephens** whose name as **President of the Jefferson County Commission** is signed to the foregoing conveyance, and who is known to me, acknowledged before me on this day that, being informed of the contents of the conveyance, he, as such officer, and with full authority, executed the same voluntarily for and as the act of said commission.

Given under my hand and official seal, this ____ day of _____, 20__.

_____
Notary Public

My Commission expires:_____

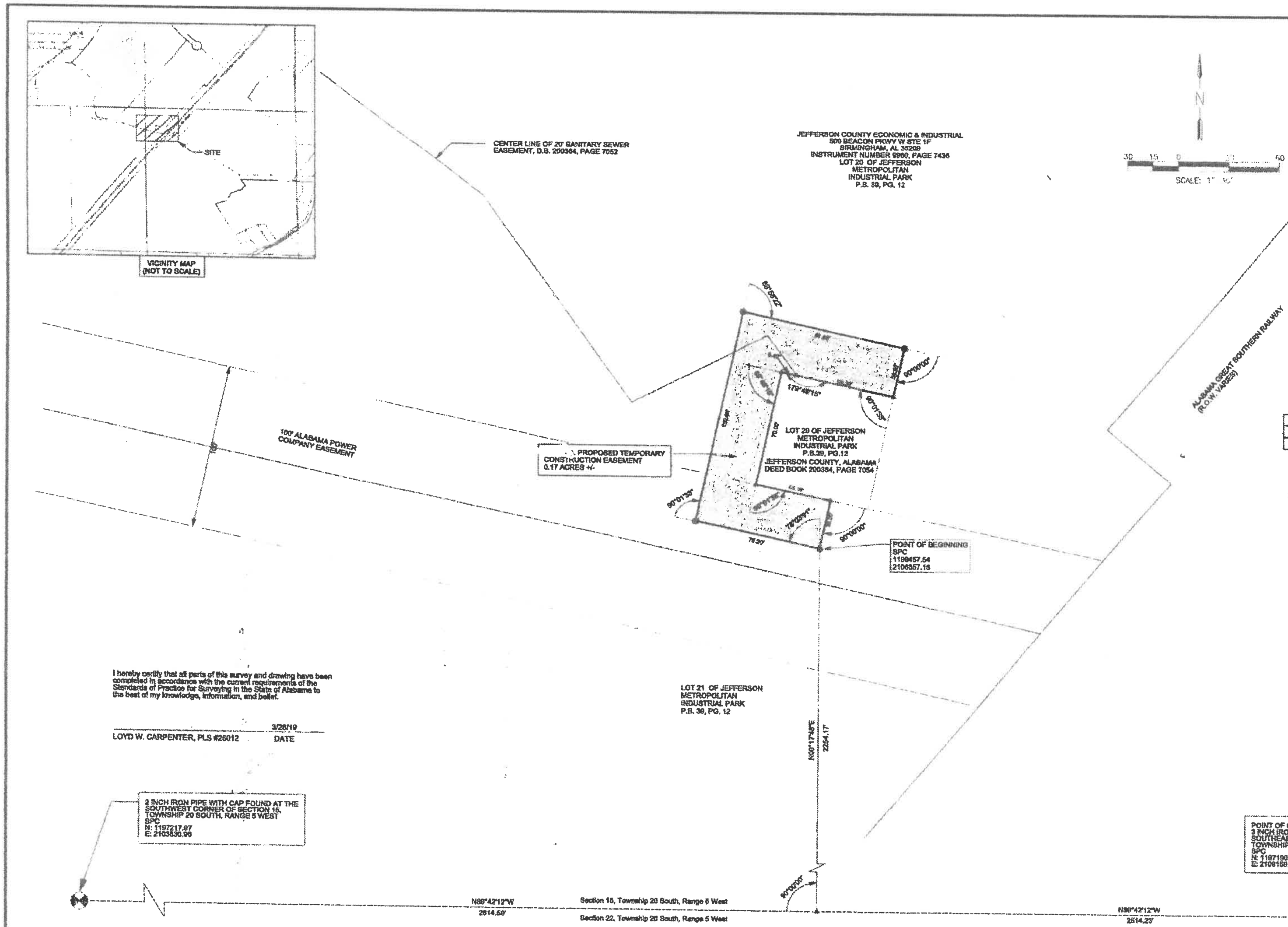
STATE OF Alabama)
COUNTY OF St. At Large)

I, Nicole VanPelt, a Notary Public, in and for said County in said State, hereby certify that John Chitwood whose named as Right of Way Svcs Supervisor of the Alabama Power Comp is signed to the foregoing instrument, and who is known to me, acknowledged before me on this day that, being informed of the contents of this instrument, he, as such officer and with full authority, executed the same voluntarily for and as the act of said Company.

Given under my hand and official seal, this the 19th day of February, 2020.

My Commission Expires: 03-21-21

Nicole VanPelt
Notary Public - State at Large



LEGEND

- ○ PROPERTY CORNER FOUND (TYPE NOTED)
- ● PROPERTY CORNER WITH A CAP STAMPED "GARVER LLC CA 448" SET
- (r) RECORD BEARING AND DISTANCE PER RECORDED DEEDS
- (c) CALCULATED
- (m) MEASURED BEARING AND DISTANCE
- OA OVERALL
- ▲ CALCULATED POINT PER RECORDED DEEDS
- ⊗ PLSS CORNER (TYPE NOTED)

GENERAL NOTES:

1. SURVEY HORIZONTAL CONTROL DATUM BASED UPON THE CONTINUOUSLY OPERATING REFERENCE STATION (CORS) AL35 CURRENTLY LOCATED IN SHELBY COUNTY, ALABAMA WITH ALL DATA PROVIDED IN NAD83 (2011).
2. BEARINGS AND COORDINATES (SPC) SHOWN HEREON ARE REFERENCED TO THE ALABAMA STATE PLANE COORDINATE SYSTEM NAD83 ALABAMA WEST

Tract	Acreage/Square Feet	Parent Tract
5	0.17 acres/ 7284.51 Square Feet	Instrument #9960, Page 7436
Total	0.17 acres/ 7284.51 Square Feet	

SURVEYOR'S NOTES

1. DATE OF FIELD SURVEY: 10/16/18
2. THIS SURVEY WAS PREPARED WITHOUT THE BENEFIT OF AN ABSTRACT OF TITLE. NO LIABILITY IS ASSUMED BY THE UNDERSIGNED FOR LOSS RELATING TO ANY MATTER THAT MIGHT BE DISCOVERED BY AN ABSTRACT OR TITLE SEARCH OF THE PROPERTY.
3. THE PREMISES SHOWN AND DESCRIBED HEREON ARE SUBJECT TO ANY EXISTING EASEMENTS, RIGHTS-OF-WAY, RESTRICTIVE COVENANTS, ZONING REGULATIONS, AND/OR SETBACK LINES WHETHER OR NOT RECORDED IN THE PUBLIC RECORDS. NO LIABILITY IS ASSUMED BY THE UNDERSIGNED FOR ANY LOSS THAT MAY BE ASSOCIATED WITH THE EXISTENCE OF ANY EASEMENTS OR RESTRICTIONS ON THE USE OF THE PROPERTY.
4. NO INVESTIGATION WAS MADE DURING THE PERFORMANCE OF THIS SURVEY TO DISCOVER EVIDENCE OF THE EXISTENCE OF ANY STRUCTURES WHICH MAY INDICATE THE LOCATION OF BURIED UTILITIES OR BURIED PIPELINES ON THE PREMISES. BURIED UTILITIES MAY OR MAY NOT EXIST. NO LIABILITY IS ASSUMED BY THE UNDERSIGNED FOR ANY LOSS THAT MAY BE ASSOCIATED WITH THE EXISTENCE OF ANY BURIED UTILITIES OR BURIED PIPELINES ON THE PREMISES.
5. SOURCE OF TITLE: INSTRUMENT NUMBER 9960, PAGE 7436

POINT OF COMMENCEMENT
3 INCH IRON PIPE WITH CAP FOUND AT THE SOUTHEAST CORNER OF SECTION 15, TOWNSHIP 20 SOUTH, RANGE 5 WEST
SPC
N: 1197190.37
E: 2109168.71

I hereby certify that all parts of this survey and drawing have been completed in accordance with the current requirements of the Standards of Practice for Surveying in the State of Alabama to the best of my knowledge, information, and belief.

LOYD W. CARPENTER, PLS #26012 — 3/28/19 — DATE

PROJECT ENGINEER: TREY TIDMORE
DESIGNED BY:
DRAWN BY: JEL/SRP/LWC
CHECKED BY: LWC
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE
ISSUED FOR — BY

TEMPORARY CONSTRUCTION EASEMENT ACQUISITION SURVEY

SECTION 15, TOWNSHIP 20 SOUTH, RANGE 5 WEST
JEFFERSON COUNTY, ALABAMA

GARVER
2111 PARKWAY OFFICE CIRCLE
Suite 100
Birmingham, AL 35244
(205) 443-3080

ASSET MANAGEMENT PROGRAM
Hazen
JEFFERSON COUNTY ENVIRONMENTAL SERVICES DEPARTMENT

2019 PUMP STATION UPGRADES No.1 JEFFERSON METROPOLITAN, McADORY, AND COLEMAN LAKES

TRACT 3
JEFFERSON METROPOLITAN P.S.
TEMPORARY CONSTRUCTION EASEMENT

MARCH 2019
PROJECT NO: 18138040
1E

EXHIBIT "B"

JEFFERSON COUNTY COMMISSION has entered into a contract with Alabama Power Company relating to this exhibit. Alabama Power Company requires the following certificates of insurance, in addition to the _____'s certificates.

If any work contemplated under this document is to be performed by outside contractors of _____, or subcontractors thereof, _____ shall present to Alabama Power Company, prior to any entity entering onto Alabama Power Company's property and right of way, acceptable policies or certificates of insurance which afford Alabama Power Company the following insurance protection:

(1) Worker's Compensation - providing insurance in statutory amounts covering the legal liability of the _____'s Contractor and their subcontractors of any tier under the applicable worker compensation and occupational disease laws of the State (or under Federal acts or statutes, including but not limited to the Longshore and Harbor Workers' Compensation Act, when applicable) for claims for personal injury including death resulting therefrom to the Contractor and its employees. Contractor shall also include Employer's Liability with a limit of at least $300,000 per person. Such insurance shall be endorsed to waive any right of subrogation for such claims against Alabama Power Company, the Southern Company and their subsidiaries.

(2) Commercial General Liability - Contractor shall provide and maintain Commercial General Liability insurance on an occurrence basis, or equivalent coverage, with a one million dollar ($1,000,000) combined single policy limit for bodily injury and/or property damage for each occurrence and in the aggregate.Business Automobile Liability – covering automobiles of the Contractor, including owned, hired and non-owned automobiles, for Bodily Injury and Property Damage with a combined single limit of $1,000,000 per occurrence.

(3) Excess or Umbrella Liability – in an amount not less than $4,000,000 for any one occurrence. Any Excess or Umbrella policy will be applicable to the general liability, auto liability and employer's liability policies required.

The Commercial General Liability, the Business Auto Liability, and the Excess Liability or Umbrella Liability insurance coverages must name the Licensor as well as their respective officers, directors, employees, agents, and representatives as additional insureds with respect to Contractors liability arising out of activities under this agreement, or activities performed on behalf of the Licensee.
Prior to beginning any work under the contract to which this is attached, Alabama Power Company shall be furnished by the Contractor with a certificate of the above insurance showing that the premium therefor has been paid. Alabama Power Company shall be furnished a ten (10) day cancellation notice of this insurance coverage.

Contractor and any subcontractors (in any) will be solely responsible for and will bear the risk of loss of or damage to any property of Contractor or subcontractor and any property for they are responsible, wherever located, and any insurance provided for such property will be solely at Contractor or its subcontractors' expense.

RIGHT-OF-WAY DEED (SEWER) **05/20/2019**
2019 Pump Station Upgrades No 1 Stuart Lee Norton
Tract # 4

County Division Code: AL040
Inst. # 2019067473 Pages: 1 of 2
I certify this instrument filed on
7/8/2019 8:21 AM Doc: D
Alan L.King, Judge of Probate
Jefferson County, AL.

Clerk: MORRISL

This instrument prepared by:
Hubert Chapman, Land Acquisition Agent
Courthouse, Ste. A-200
716 Richard Arrington Jr., Blvd. North
Birmingham, AL 35203

STATE OF ALABAMA)

JEFFERSON COUNTY)

KNOW ALL MEN BY THESE PRESENTS: That for and in consideration of the sum of Two Hundred and No/100 Dollars ($200.00) cash in hand paid by Jefferson County, the receipt whereof is hereby acknowledged, do hereby grant, bargain, sell and convey unto the said Jefferson County, its successors and assigns, a temporary construction easement for sanitary sewer purposes, including the installation and maintenance of sewer pipelines, underground and on the surface, and underground and surface support facilities, including stations, access points, stubouts and manholes, said temporary construction easement being located in Jefferson County, Alabama and described as follows, to-wit:

A Temporary Construction Easement more particularly described as follows:

Commence at a 3" pipe located at the Northeast corner of the Northeast ¼ of Section 22, Township 20 South, Range 5 West; thence run west along the north boundary line of said section for a distance of 1852.82 feet; thence turn an angle left 90°0′0″ and run southerly for a distance of 1017.88 feet to the southwest corner of the Grantor's property line; thence turn an angle right 145°29′05″ and run northwesterly for a distance of 10.00 feet to the **Point of Beginning** of a variable width Temporary Construction Easement being bound on the southeasterly side by the northwesterly prescriptive right of way of Eastern Valley Road and being bound on the northwesterly side by the following described line, also being the point of beginning of a curve to the right having a radius of 5261.57 feet, a chord direction of N 53°13′19″ E, a chord length of 158.39 feet, and an arc length of 158.39 feet; thence turn an angle right 89°26′26″ to chord and run northeasterly along the arc of said curve for a distance of 158.39 feet to the end of said curve; thence run northeasterly along the tangent of said curve for a distance of 41.61 feet to the end of said Temporary Construction Easement.

The outer boundaries of said Temporary Construction Easement being extended or trimmed as necessary to terminate at the property lines of the Grantor.

All of said Temporary Construction Easement is located in the NW ¼ of the NE ¼, Section 22, Township 20 South, Range 5 West, and contains 0.05 acres more or less.

The Temporary Construction Easement will terminate upon the completion and acceptance of said project and thereafter will constitute no cloud on the title of the Grantor.

For the consideration aforesaid, the undersigned do grant bargain sell and convey unto the said County the right and privilege of a perpetual use of said lands for such public purpose, together with all rights and privileges necessary or convenient for the full use and enjoyment thereof, including the right of ingress to and egress from said strip and the right to cut and keep clear all trees, undergrowth and other obstructions on the lands of the undersigned adjacent to said strip when deemed reasonably necessary for the avoidance of danger in and about said public use of said strip, and the right to prohibit the construction or Maintenance of any improvement or obstruction (except fencing) or the placement of spoil or fill dirt and/or heavy equipment over or on top of the easement/right-of-way without the written permission of the Jefferson County Commission or its authorized agent.

In consideration of the benefit to the property of the undersigned by reason of the construction of said sewer facility, the undersigned hereby release Jefferson County, the State of Alabama, and/or the United States of America, and/or any of their agents, from all damages present or prospective to the property of the undersigned arising or resulting from the construction, maintenance and repair of said improvement, and the undersigned do hereby admit and acknowledge that said sewer facility, if and when constructed, will be a benefit to the property of the undersigned.

The undersigned covenant with said Jefferson County that the undersigned are seized in fee-simple of said premises and have a good right to sell and convey the same and that the same are free from all encumbrances, and the undersigned will warrant and defend the title to the aforegranted strip of ground from and against the lawful claims of all persons whomsoever.

IN WITNESS WHEREOF, the undersigned have hereunto set their hands and seals, all on this 21 day of May 2019.

Stuart Lee Norton (SEAL) _____ (SEAL)
Stuart Lee Norton, a single man

STATE OF ALABAMA)

JEFFERSON COUNTY)

I, THE UNDERSIGNED AUTHORITY, in and for said County, in said State, hereby certify that Stuart Lee Norton whose name is signed to the foregoing conveyance, and who is known to me, acknowledged before me on this day that, being informed of the contents of the conveyance, he executed the same voluntarily on the date the same bears date.

Given under my hand and official seal, this 21 day of MAY, 2019.

My commission expires _____.

Notary Public

MY COMMISSION EXPIRES OCTOBER 8, 2022

RIGHT-OF-WAY DEED (SEWER) **10/04/2019**
2019 Pump Station Upgrades No 1 Shannon & Pamela Hollon
Tract # 5

This instrument prepared by:
Hubert Chapman, Land Acquisition Agent
Courthouse, Ste. A-200
716 Richard Arrington Jr., Blvd. North
Birmingham, AL 35203

County Division Code: AL040
Inst. # 2019121992 Pages: 1 of 2
I certify this instrument filed on
11/21/2019 3:22 PM Doc: D
Alan L.King, Judge of Probate
Jefferson County, AL.

Clerk: NICOLE

STATE OF ALABAMA)

JEFFERSON COUNTY)

KNOW ALL MEN BY THESE PRESENTS: That for and in consideration of the sum of Five Hundred and no/100's Dollars ($500.00) cash in hand paid by Jefferson County, the receipt whereof is hereby acknowledged, do hereby grant, bargain, sell and convey unto the said Jefferson County, its successors and assigns, a temporary construction easement for sanitary sewer purposes, including the installation and maintenance of sewer pipelines, underground and on the surface, and underground and surface support facilities, including stations, access points, stubouts and manholes, said temporary construction easement being located in Jefferson County, Alabama and described as follows, to-wit:

A Temporary Construction Easement more particularly described as follows:

Commence at a 3" pipe located at the Northeast corner of the Northeast ¼ of Section 22, Township 20 South, Range 5 West; thence run west along the north boundary line of said section for a distance of 1523.45 feet; thence turn an angle left 90°0′0″ and run southerly for a distance of 790.67 feet to the southeast corner of the Grantor's property line; thence turn an angle right 145°28′37″ and run northwesterly for a distance of 10 feet for the **Point of Beginning** of a variable width Temporary Construction Easement being bound on the southeasterly side by the northwesterly prescriptive right of way of Eastern Valley Road and being bound on the northwesterly side by the following described line; thence turn an angle left 89°46′46″ and run southwesterly for a distance of 200.12 feet to the end of said Temporary Construction Easement.

The outer boundaries of said Temporary Construction Easement being extended or trimmed as necessary to terminate at the property lines of the Grantor.

All of said Temporary Construction Easement is located in the NW ¼ of the NE ¼, Section 22, Township 20 South, Range 5 West, and contains 0.05 acres more or less.

The Temporary Construction Easement will terminate upon the completion and acceptance of said project and thereafter will constitute no cloud on the title of the Grantor.

For the consideration aforesaid, the undersigned do grant bargain sell and convey unto the said County the right and privilege of a perpetual use of said lands for such public purpose, together with all rights and privileges necessary or convenient for the full use and enjoyment thereof, including the right of ingress to and egress from said strip and the right to cut and keep clear all trees, undergrowth and other obstructions on the lands of the undersigned adjacent to said strip when deemed reasonably necessary for the avoidance of danger in and about said public use of said strip, and the right to prohibit the construction or Maintenance of any improvement or obstruction (except fencing) or the placement of spoil or fill dirt and/or heavy equipment over or on top of the easement/right-of-way without the written permission of the Jefferson County Commission or its authorized agent.

In consideration of the benefit to the property of the undersigned by reason of the construction of said sewer facility, the undersigned hereby release Jefferson County, the State of Alabama, and/or the United States of America, and/or any of their agents, from all damages present or prospective to the property of the undersigned arising or resulting from the construction, maintenance and repair of said improvement, and the undersigned do hereby admit and acknowledge that said sewer facility, if and when constructed, will be a benefit to the property of the undersigned.

The undersigned covenant with said Jefferson County that the undersigned are seized in fee-simple of said premises and have a good right to sell and convey the same and that the same are free from all encumbrances, and the undersigned will warrant and defend the title to the aforegranted strip of ground from and against the lawful claims of all persons whomsoever.

IN WITNESS WHEREOF, the undersigned have hereunto set their hands and seals, all on this 4th day of October 2019.

_____ (SEAL) _____ (SEAL)
Shannon Hollon, a married man Pamela Hollon, wife

STATE OF ALABAMA)

JEFFERSON COUNTY)

I, THE UNDERSIGNED AUTHORITY, in and for said County, in said State, hereby certify that Shannon & Pamela Hollon whose names are signed to the foregoing conveyance, and who are known to me, acknowledged before me on this day that, being informed of the contents of the conveyance, they executed the same voluntarily on the date the same bears date.

Given under my hand and official seal, this 4th day of October, 2019.

My commission expires _____.

_____
Notary Public

MY COMMISSION EXPIRES OCTOBER 8, 2022

This instrument prepared by:
Hubert Chapman, Land Acquisition Agent
Courthouse, Ste. A-200
716 Richard Arrington Jr., Blvd. North
Birmingham, AL 35203

County Division Code: AL040
Inst. # 2019107253 Pages: 1 of 2
I certify this instrument filed on
10/11/2019 1:35 PM Doc: D
Alan L.King, Judge of Probate
Jefferson County, AL.

Clerk: SANDERSL

STATE OF ALABAMA)

JEFFERSON COUNTY)

KNOW ALL MEN BY THESE PRESENTS: That for and in consideration of the sum of Two hundred and no/100 Dollars ($200.00) cash in hand paid by Jefferson County, the receipt whereof is hereby acknowledged, do hereby grant, bargain, sell and convey unto the said Jefferson County, its successors and assigns, a temporary construction easement for sanitary sewer purposes, including the installation and maintenance of sewer pipelines, underground and on the surface, and underground and surface support facilities, including stations, access points, stubouts and manholes, said temporary construction easement being located in Jefferson County, Alabama and described as follows, to-wit:

A Temporary Construction Easement more particularly described as follows:

Commence at a 3" pipe located at the Northeast corner of the Northeast ¼ of Section 22, Township 20 South, Range 5 West; thence run west along the north boundary line of said section for a distance of 1523.45 feet; thence turn an angle left 90°0′0″ and run southerly for a distance of 790.67 feet to the southwest corner of the Grantor's property line; thence turn an angle right 145°28′37″ and run northwesterly for a distance of 10 feet for the **Point of Beginning** of a variable width Temporary Construction Easement being bound on the southeasterly side by the northwesterly prescriptive right of way of Eastern Valley Road and being bound on the northwesterly side by the following described line; thence turn an angle right 90°21′17″ and run northeasterly for a distance of 200.17 feet to the end of said Temporary Construction Easement.

The outer boundaries of said Temporary Construction Easement being extended or trimmed as necessary to terminate at the property lines of the Grantor.

All of said Temporary Construction Easement is located in the NW ¼ of the NE ¼, Section 22, Township 20 South, Range 5 West, and contains 0.05 acres more or less.

The Temporary Construction Easement will terminate upon the completion and acceptance of said project and thereafter will constitute no cloud on the title of the Grantor.

For the consideration aforesaid, the undersigned do grant bargain sell and convey unto the said County the right and privilege of a perpetual use of said lands for such public purpose, together with all rights and privileges necessary or convenient for the full use and enjoyment thereof, including the right of ingress to and egress from said strip and the right to cut and keep clear all trees, undergrowth and other obstructions on the lands of the undersigned adjacent to said strip when deemed reasonably necessary for the avoidance of danger in and about said public use of said strip, and the right to prohibit the construction or Maintenance of any improvement or obstruction (except fencing) or the placement of spoil or fill dirt and/or heavy equipment over or on top of the easement/right-of-way without the written permission of the Jefferson County Commission or its authorized agent.

In consideration of the benefit to the property of the undersigned by reason of the construction of said sewer facility, the undersigned hereby release Jefferson County, the State of Alabama, and/or the United States of America, and/or any of their agents, from all damages present or prospective to the property of the undersigned arising or resulting from the construction, maintenance and repair of said improvement, and the undersigned do hereby admit and acknowledge that said sewer facility, if and when constructed, will be a benefit to the property of the undersigned.

The undersigned covenant with said Jefferson County that the undersigned are seized in fee-simple of said premises and have a good right to sell and convey the same and that the same are free from all encumbrances, and the undersigned will warrant and defend the title to the aforegranted strip of ground from and against the lawful claims of all persons whomsoever.

IN WITNESS WHEREOF, the undersigned have hereunto set their hands and seals, all on this 5th day of August 2019.

Jacky Shubert (SEAL)
Jacky Shubert, a married man

Kim Shubert (SEAL)
Kim Shubert, wife

STATE OF ALABAMA)

JEFFERSON COUNTY)

I, THE UNDERSIGNED AUTHORITY, in and for said County, in said State, hereby certify that Jacky Shubert & Kim Shubert whose names are signed to the foregoing conveyance, and who are known to me, acknowledged before me on this day that, being informed of the contents of the conveyance, they executed the same voluntarily on the date the same bears date.

Given under my hand and official seal, this 5th day of August, 2019.

My commission expires 10/8/2022.

Notary Public

MY COMMISSION EXPIRES OCTOBER 8, 2022

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APPENDIX H
GEOTECHNICAL REPORT

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Subsurface Exploration Report

Proposed Improvements to Jefferson Metro Pump Station
7250 Jefferson Metro Parkway
McCalla, Alabama

February 4, 2019
Terracon Project No. E1185334

Prepared for:
Hazen and Sawyer
Birmingham, Alabama

Prepared by:
Terracon Consultants, Inc.
Birmingham, Alabama

February 4, 2019

Hazen and Sawyer
Two Chase Corporate Drive
Suite 170
Hoover, AL 35244

Attn: Ms. Celeste T. Lachenmyer, P.E.
Associate
E: clachenmyer@hazenandsawyer.com

Re: Subsurface Exploration Report
Proposed Improvements to Jefferson Metro Pump Station
7250 Jefferson Metro Parkway
McCalla, Alabama
Terracon Project Number: E1185334

Dear Celeste,

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. This study was performed in general accordance with our proposal number PE1185334, dated December 10, 2018. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Samuel E. Brancheau, P.E., P.G.
Project Engineer

Bryan Ritenour, P.E., P.G.
Senior Engineer
Alabama PE No. 17908

TABLE OF CONTENTS

SUBSURFACE EXPLORATION REPORT
PROPOSED IMPROVEMENTS TO JEFFERSON METRO PUMP STATION
7250 Jefferson Metro Parkway
McCalla, Alabama

Terracon Project No. E1185334
February 4, 2019

1.0 INTRODUCTION

This subsurface exploration has been performed for the proposed Improvements to the Jefferson Metro Pump Station at 7250 Jefferson Metro Parkway in McCalla, Alabama. The proposed improvements include installation of a new wet well, manholes, and ductile iron inlet and outlet pipe. Two (2) borings (B-1 and B-2) were advanced just outside of the existing pump station fence to auger refusal depths of 13.5 and 16 feet below existing ground surface (bgs), respectively. Logs of the borings, along with a site location map, boring location plan, and a description of the field exploration procedures are included in Appendix A.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- excavation conditions

2.0 PROJECT INFORMATION

We understand that the planned construction improvements will include a new 12-foot by 20-foot wet well installation (replacing the existing 8-foot wet well), 5 and 6-foot diameter manholes, and associated 24-inch diameter ductile iron inlet and outlet pipes. The wet well will extend to an invert elevation of 488.5 feet, approximately 27.5-feet below the grade of the existing pump station. Recommended boring locations were provided by Garver prior to the start of the field exploration program.

A total of two (2) geotechnical soil borings were advanced just outside of the existing pump station fence to auger refusal. Temporary piezometers were installed in each boring to measure the static groundwater level. Locations of these borings are presented as Exhibit A-2 in Appendix A.

3.0 SUBSURFACE CONDITIONS

3.1 Geology

The project site is underlain by the Conasauga Formation. This formation consists of medium-bluish-gray, fine-grained, thin-bedded argillaceous limestone and interbedded dark-gray shale in varying proportions.

Limestone, such as those underlying the subject site, is carbonate based rock and is therefore soluble in slightly acidic groundwater. Weathering is typified by a chemical solutioning process that progresses along joints, fractures and bedding planes in the bedrock. This process often results in a highly irregular rock profile that contains deep weathered slots filled with soft soils. Voids or caves may also be present in the bedrock. Surface depressions or sinkholes are formed when the soil overburden is lost into these subsurface caverns.

No visible evidence of sinkholes was noted on the project site during the course of this exploration. However, as with any site underlain by a carbonate bedrock formation, there is always the risk of future sinkhole development. Prediction of future sinkhole occurrence is very difficult and even an extensive subsurface exploration would not likely rule out the possibility of sinkhole activity. Should sinkholes be encountered during construction, we can provide sinkhole remediation recommendations.

3.2 Typical Profile

Each boring initially encountered a thin layer of gravel base rock and was immediately underlain by 3.5 feet of fill. In boring B-1, the fill consisted of light gray silty sand with gravel, and in boring B-2, the fill consisted of yellowish-red lean clay with cherty sand.

Residual fat Clay (CH) with varying percentages of sand underlies the fill layer in both borings, extending to a depth of 13.5 feet in boring B-1, and 8.5 feet in boring B-2. The fat clay is generally yellowish brown, with Standard Penetration Test (SPT) N-Values ranging between 9 to 12 blows per foot (bpf), indicative of stiff soil. However, fat clay sampled in boring B-1 at 8.5 to 10-feet encountered SPT refusal (defined as greater than 50 hammer blows for any 6-inch interval), which was likely a cobble or weathered rock not recovered in the sampling spoon.

Boring B-1 encountered auger refusal at 13.5 feet bgs. Boring B-2 encountered weathered limestone at 8.5 feet bgs then subsequently encountered auger refusal at 16 feet bgs. It is assumed that harder, less weathered limestone is present at the project site below the auger refusal depths.

Laboratory testing was performed on select soil samples collected from each boring. One moisture content test was performed representative of the cohesive fill soil, with a result of 23-

percent. An additional four moisture content tests were performed on residual fat clay samples, with results ranging from 29 to 31 percent. In addition, Atterberg limits tests were performed, with results summarized in the following table:

Sample Location and Depth	Liquid Limit	Plastic Limit	Plasticity Index
B-1, 3.5 to 5.0 feet	63	29	34
B-2, 6.0 to 7.5 feet	66	31	35

Conditions encountered at each boring location, as well as applicable index tests, are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in situ, the transition between materials may be gradual. A detailed log for each boring can be found in Appendix A.

3.3 Groundwater

The boreholes were observed during drilling for the presence of groundwater. Groundwater was not observed in either boring during drilling, or for the short period of time the borings remained open prior to installation of the temporary piezometers.

Temporary piezometers were subsequently installed in borings B-1 and B-2 upon completion of drilling. Each piezometer consisted of a 2-inch diameter Schedule 40 PVC pipe with a 10-ft screen interval. Backfilling of the piezometers consisted of clean, well-graded sand to 1-foot above the top of the screen, then a concrete seal from the top of the sand layer to the existing ground surface. The PVC was capped with a pipe plug to prevent influx of surface water and rainwater. In boring B-1, the screened interval was installed from 3.5 feet to 13.5 feet below ground surface. In boring B-2, the screened interval was installed from 6 feet to 16 feet below ground surface. An initial groundwater measurement immediately after installation of the piezometers was not taken. Terracon returned to the site on two occasions to measure groundwater level. Dates and measurements are presented on the boring logs in Appendix A, and are summarized in the following table:

Boring	Date	Groundwater Level (ft bgs)[1]	Groundwater Elevation (ft)[1]
B-1	01/23/2019	7.1	506.9
	01/28/2019	6.4	507.6
B-2	01/23/2019	8.15	505.85
	01/28/2019	6.6	507.4

1. Groundwater elevation based on assumed ground surface elevation of approximately 514.0 ft at boring locations, based on previous site survey information provided by Garver.

The project site is adjacent to a pond and a system of small tributaries. Additionally, the project site experienced significant rainfall on the date of the first reading (January 23, 2019), and again prior to the date of the second reading.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 CONSIDERATIONS FOR DESIGN AND CONSTRUCTION

4.1 Excavation Considerations

Based on the results of our field exploration, we anticipate fill, residual high plasticity clay soils, and bedrock will be encountered during excavation for the new wet well, manholes, and utility trenches. The upper fill, residual fat clay soils, and the highly weathered limestone can be removed utilizing conventional excavation equipment. We anticipate that groundwater will be encountered during excavation for the new structures, therefore contractors should be prepared to take dewatering measures (e.g., sump pit and pump) during the excavation to mitigate excessive groundwater infiltration within the excavation.

Although rock coring was not performed during the subsurface exploration, it is assumed that hard limestone is present below the auger refusal depths in borings B-1 and B-2, with estimated top of rock elevations of 500.5 and 498 feet, respectively. According to the pump station wet well connection details provided by Garver, the inside floor elevation of the wet well is 488.5 feet, the pipe invert connect at the wet well is 496 feet, and the pipe invert elevations at the manholes range between 496.8 feet to 498.5 feet. Based on these elevations, the excavation and grading contractor should expect to encounter bedrock prior to reaching finished grade for any of the structures. Further, it is possible that bedrock pinnacles may be encountered in the areas between and outside of the borings where excavation is required. Removal of the bedrock would require jack hammering or hoe-ramming for removal. If blasting is considered for rock removal, consideration should be given to the proximity to railroad tracks as well as structures for the existing pump station.

It is assumed the existing wet well will be completely removed during excavation. Information on the installation of the existing wet well has not been provided as of the date of this report. We caution that material not disclosed within the borings completed for this project may be present around the existing wet well perimeter.

4.2 Fill Placement and Compaction Considerations

Based on the high plasticity and expansive potential, the residual fat clay soil on site should not be re-used as engineered fill for support of the wet well, manholes, or inlet/outlet pipe, and should not be used as backfill around the perimeter of the wet well or manholes. However, all soils may be used as backfill for utility trenches above the inlet/outlet pipes. Recommendations for compaction and moisture content of import fill is presented in the following table:

Fill Lift Thickness	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches or less in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used
Compaction Requirements [1]	In settlement-sensitive areas (i.e. below pavements), 95% of the material's maximum standard Proctor dry density (ASTM D 698) or in accordance with Jefferson County requirements
Moisture Content Cohesive Soil	Within +/- 2 percentage points of optimum moisture content as determined by the standard Proctor test at the time of placement and compaction
Moisture Content Granular Material [2]	Within +/- 3 percentage points of optimum moisture content as determined by the standard Proctor test at the time of placement and compaction

1. We recommend that compacted engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

4.3 Utility Trench Backfill

All trench excavations within should be made with sufficient working space to permit construction including backfill placement and compaction. If utility trenches are backfilled with relatively clean granular material, they should be capped with at least 18 inches of cohesive fill in non-pavement areas to reduce the infiltration and conveyance of surface water through the trench backfill.

4.4 Temporary Slope Considerations

Temporary excavations will be required to install the wet well, manholes, and inlet/outlet pipe. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Based on the piezometer monitoring for this project, groundwater seepage is expected to be encountered in all excavations. Additionally, strata of poorly compacted fill may be encountered. The grading contractor should be aware of this and take the necessary precautions when

designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom.

Shoring and bracing will be necessary for steeper excavations. Braced excavations can include a complicated design and construction process. A separate and extensive evaluation of subsurface conditions with regards to braced excavations should be conducted by the contractor(s) prior to beginning excavation. The design, evaluation, and construction of the shoring and bracing system is solely the responsibility of the contractor.

Proper management of groundwater seepage and surface water runoff around the excavations will also contribute to the stability of temporary slopes. Material removed from excavations should not be stockpiled within a distance of ten feet from the crest of temporary excavations. Furthermore, positive drainage should also be maintained with ditches or channels at the top and bottom of the slope. It is also very important to always keep these drainage channels free of dirt, debris and vegetation.

During construction, all temporary slopes should be regularly inspected for signs of movement or unsafe conditions. Soil slopes should be covered for protection from rain and surface runoff should be diverted away from the slopes.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical

engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION

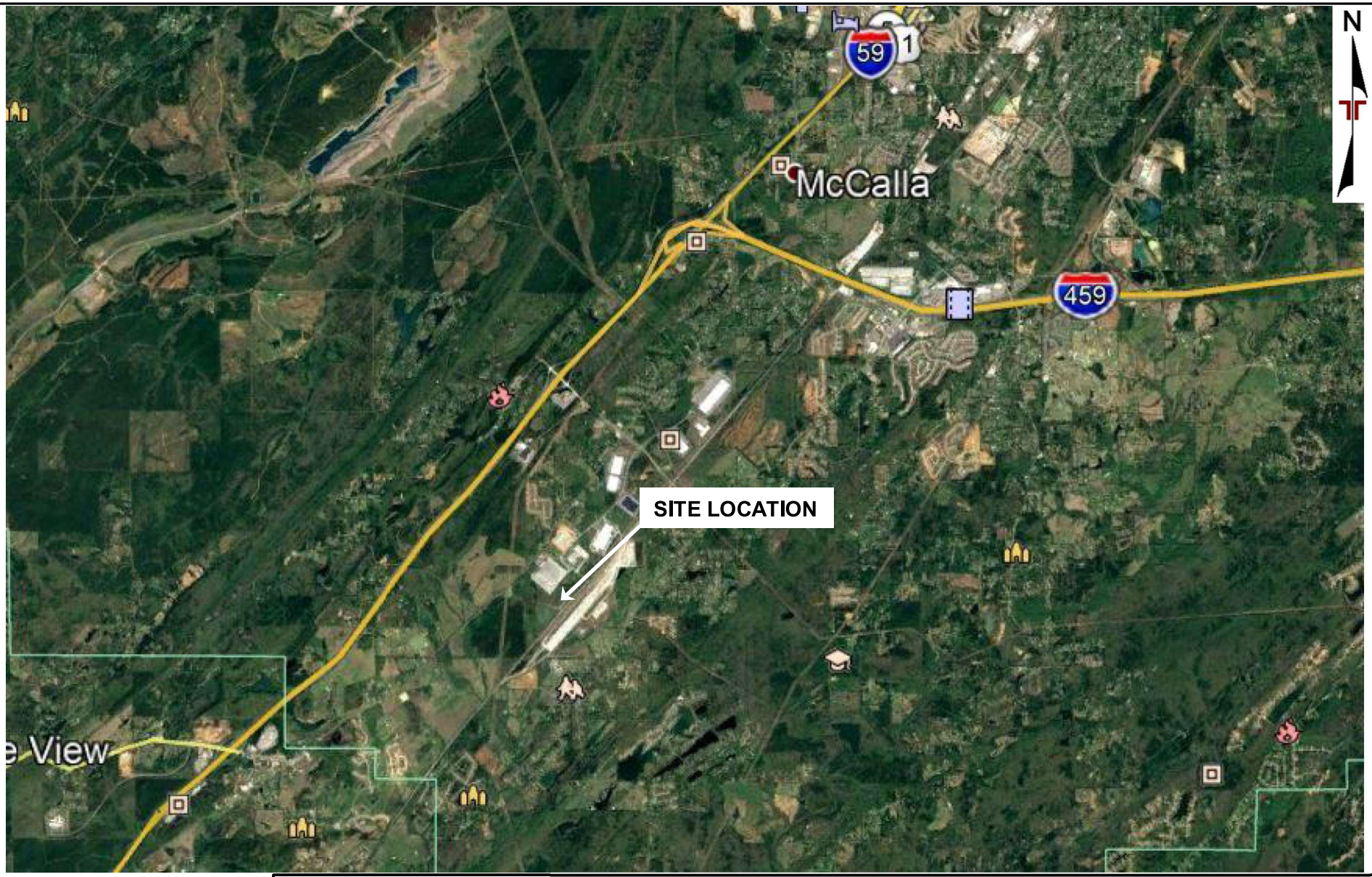


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager:	SB
Drawn by:	SB
Checked by:	BCR
Approved by:	BCR

Project No.	E1185334
Scale:	N.T.S.
File Name:	
Date:	02/04/2019

Terracon
Consulting Engineers & Scientists
2147 Riverchase Office Road Birmingham, Alabama 35244
PH. (205) 942-1289 FAX. (205) 443-5302

SITE LOCATION MAP

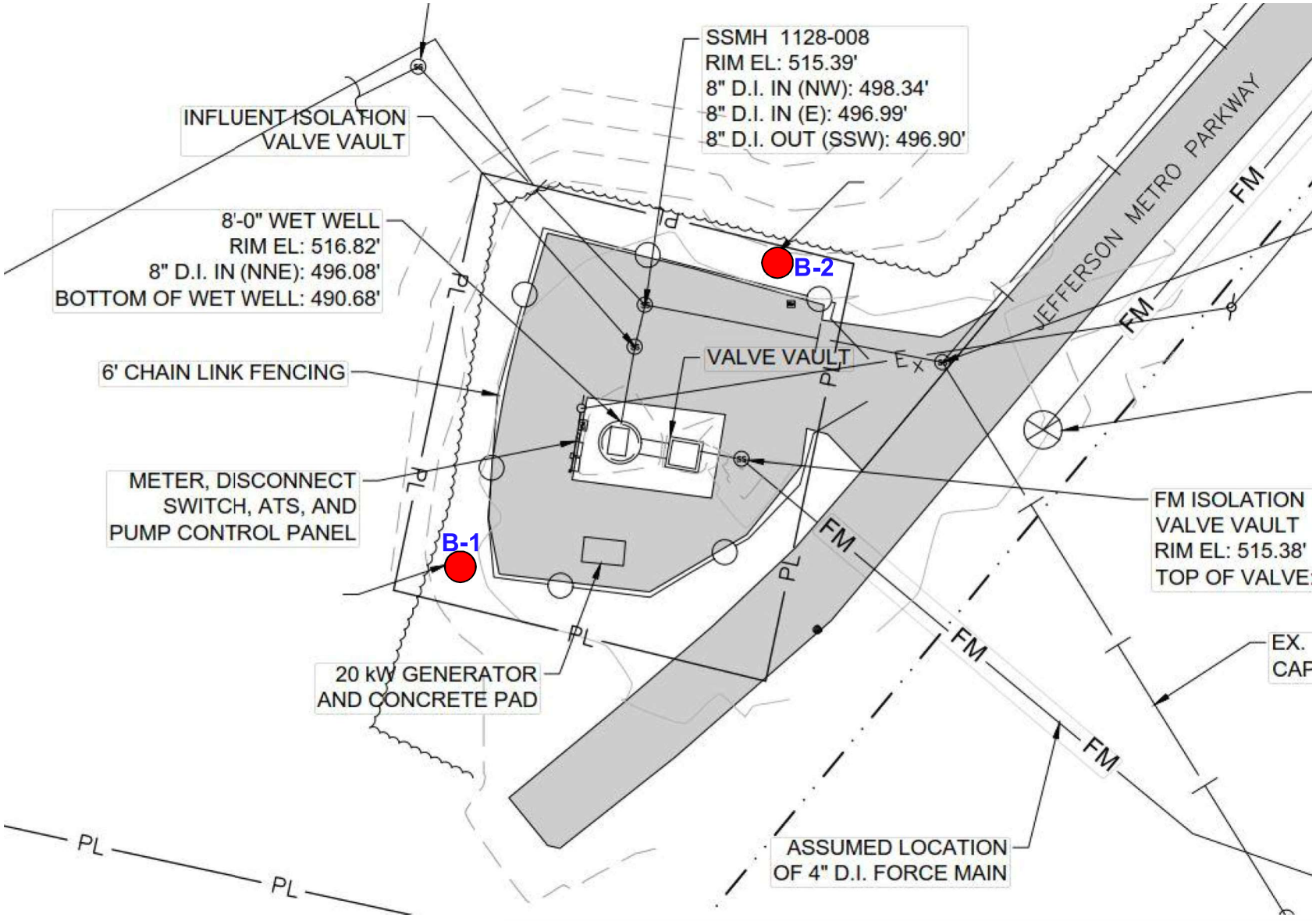
Jefferson Metro Pump Station Improvements

7250 Jefferson Metro Parkway

McCalla, Alabama

Exhibit

A-1



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BORING LOCATION PLAN

Jefferson Metro Pump Station Improvements

7250 Jefferson Metro Parkway

McCalla, Alabama

Exhibit

A-2

Field Exploration Description

The proposed boring locations were marked on a plan provided by Hazen and Sawyer and Garver, and were laid out in the field by a Terracon representative. The locations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with a trailer-mounted rotary drill rig using hollow-stem augers to advance the boreholes. Samples of the soil encountered in the borings were obtained using the split-barrel sampling procedures using a spinning cat-head SPT hammer.

In the split-barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (SPT-N). This value is used to estimate the in situ relative density of cohesionless soils and consistency of cohesive soils.

The samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination. Information provided on the boring logs attached to this report includes soil descriptions, consistency evaluations, boring depths, sampling intervals, and groundwater conditions. The borings were backfilled with auger cuttings prior to the drill crew leaving the site.

A field log of each boring was prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

Temporary piezometers were installed in each boring, consisting of 2-inch diameter Schedule-40 PVC with a screened interval of 10-feet. Specific screened interval depths and backfill details are presented on the boring logs (Exhibits A-4 and A-5).

BORING LOG NO. B-1

PROJECT: Proposed Improvements to Jefferson Metro Pump Station

CLIENT: Hazen and Sawyer, P.C.
Hoover, AL

SITE: 7250 Jefferson Metro Parkway
Birmingham, AL

LOCATION See Exhibit A-2

Approximate Surface Elev.: 514 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.3	514+/-	**GRAVEL (3")**
		FILL - SILTY SAND WITH GRAVEL, light gray, fine to coarse sand, fine to coarse angular gravel
3.5	510.5+/-	
		FAT CLAY (CH), yellowish-brown, stiff, trace fine to coarse sand
8.5	505.5+/-	
		FAT CLAY WITH SAND (CH), olive-gray and yellowish-brown, hard, fine to coarse sand, trace fine angular gravel
13.5	500.5+/-	
		Auger Refusal at 13.5 Feet

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
		3-3-4 N=7		
5		4-5-7 N=12	31	63-29-34
		4-4-6 N=10	31	
10		6-18-50/5" N=50+		
		50/0" N=50+		

WATER LEVEL OBSERVATIONS: ▽ ▽

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Installed temporary piezometer (see notes)

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
Installed 2" SCH-40 PVC temporary piezometer with screened interval from 3.5'-13.5'. Backfilled with clean, well-graded sand to 1' above screened interval then concrete seal to ground surface.

WATER LEVEL OBSERVATIONS

▽ *Water observed at 7.1 ft bgs on 1/23/2019*

▽ *Water observed at 6.4 ft bgs on 1/28/2019*

Terracon
2147 Riverchase Office Rd
Hoover, AL

Boring Started: 01-21-2019 | Boring Completed: 01-21-2019

Drill Rig: Mobile B-47 | Driller: Earth Core, LLC

Project No.: E1185334 | Exhibit: A-4

BORING LOG NO. B-2

PROJECT: Proposed Improvements to Jefferson Metro Pump Station

CLIENT: Hazen and Sawyer, P.C. Hoover, AL

SITE: 7250 Jefferson Metro Parkway Birmingham, AL

LOCATION See Exhibit A-2

Approximate Surface Elev.: 514 (Ft.) +/-

DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
0.2	**GRAVEL (2")**	514+/-						
	FILL - LEAN CLAY WITH SAND, yellowish-red, fine to coarse cherty sand				X	2-2-3 N=5	23	
3.5		510.5+/-						
	FAT CLAY (CH), yellowish-brown, stiff, fine to coarse sand, one large gravel piece, trace roots		5		X	4-4-5 N=9	29	
				▽ (6.6 ft)	X	4-4-5 N=9	29	66-31-35
8.5		505.5+/-		▽ (8.15 ft)				
	WEATHERED LIMESTONE, sampled as fine to coarse angular gravel with clay and sand, possibly a broken cobble/boulder		10		X	50/5" N=50+		
						50/0" N=50+		
16.0		498+/-	15					
	Auger Refusal at 16 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Installed temporary piezometer (see notes)

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Installed 2" SCH-40 PVC temporary piezometer with screened interval from 6'-16'. Backfilled with clean, well-graded sand to 1' above screened interval then concrete seal to ground surface.

WATER LEVEL OBSERVATIONS

▽ *Water observed at 8.15 ft bgs on 1/23/2019*

▽ *Water observed at 6.6 ft bgs on 1/28/2019*

Terracon
2147 Riverchase Office Rd
Hoover, AL

Boring Started: 01-21-2019	Boring Completed: 01-21-2019
Drill Rig: Mobile B-47	Driller: Earth Core, LLC
Project No.: E1185334	Exhibit: A-5

APPENDIX B
LABORATORY TESTING

Laboratory Testing

The project engineer reviews the field data and assigns various laboratory tests to better understand the engineering properties of the various soil strata as necessary for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods are applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

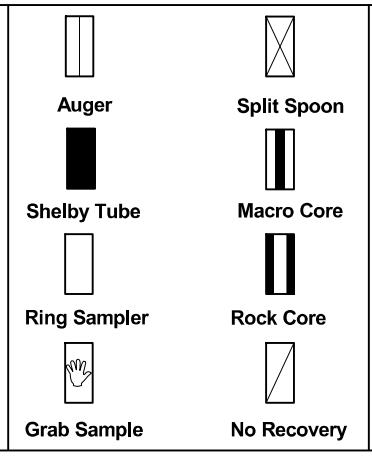
The laboratory testing program often includes examination of soil samples by an engineer. Based on the material's texture and plasticity, we describe and classify the soil samples in accordance with the Unified Soil Classification System.

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING



WATER LEVEL

Water Initially Encountered

Water Level After a Specified Period of Time

Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, psf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42
			Hard	> 8,000	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.

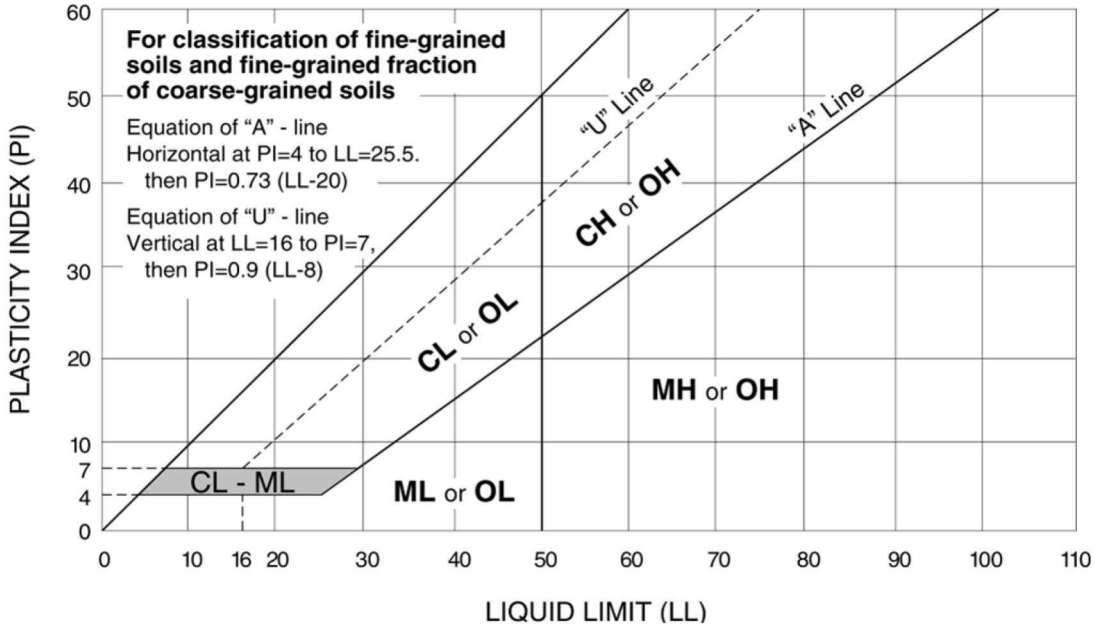


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Exhibit C-2